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# A comparison of an alternative inventory control concept with the Navy's existing wholesale inventory control procedures for repairables

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# NAVAL POSTGRADUATE SCHOOL
## Monterey, California

# THESIS

**A COMPARISON OF AN ALTERNATIVE INVENTORY CONTROL CONCEPT WITH THE NAVY'S EXISTING WHOLESALE INVENTORY CONTROL PROCEDURES FOR REPAIRABLES**

by

David R. Kless

September 1998

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The Director of Planning and Operations Research Department, Naval Inventory Control Point (NAVICP) Code M041, requested a study to compare the performance of two sets of inventory control procedures for managing high-cost repairable items. One of these sets is embedded in the Navy's existing wholesale inventory control system. The procedures of this set characterize a periodic review process, which calculates four decision variables in order to manage Navy inventories. These variables represent how much to order, how much to repair, when to order, and when to repair. The other set of procedures are adapted from a commercial software package called Bandwidth Management developed by Stewart-Frazier Tools Inc. Two versions of these latter procedures are modeled in this thesis. These procedures characterize a periodic review process, which calculates three decision variables. These variables represent how much to deliver, how much to repair, and when to repair. This thesis uses simulation to model the two sets of procedures and to compare their performance with respect to three formal measures of effectiveness adopted by NAVICP: Supply Material Availability (SMA), Average Delay for a Delayed Requisition (ADDR), and Average Monthly Investment Level (AMIL). The comparison results of the thesis indicate that the existing Navy inventory procedures generate better performance in all three formal measures of effectiveness.

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# A COMPARISON OF AN ALTERNATIVE INVENTORY CONTROL CONCEPT WITH THE NAVY'S EXISTING WHOLESALE INVENTORY CONTROL PROCEDURES FOR REPAIRABLES

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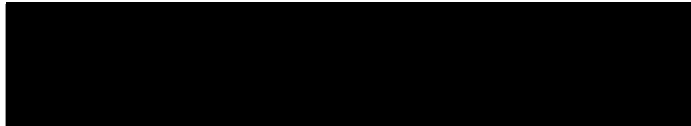B.S., United States Naval Academy, 1987

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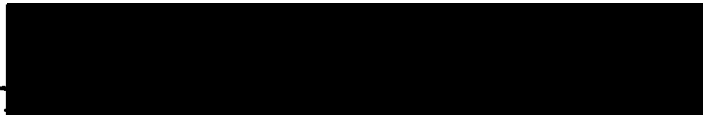
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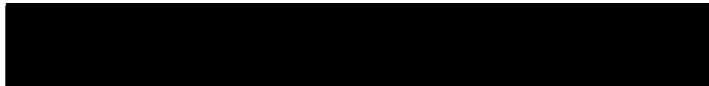
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# ABSTRACT

The Director of Planning and Operations Research Department, Naval Inventory Control Point (NAVICP) Code M041, requested a study to compare the performance of two sets of inventory control procedures for managing high-cost repairable items. One of these sets is embedded in the Navy's existing wholesale inventory control system. The procedures of this set characterize a periodic review process, which calculates four decision variables in order to manage Navy inventories. These variables represent how much to order, how much to repair, when to order, and when to repair. The other set of procedures are adapted from a commercial software package called Bandwidth Management developed by Stewart-Frazier Tools Inc. Two versions of these latter procedures are modeled in this thesis. These procedures characterize a periodic review process, which calculates three decision variables. These variables represent how much to deliver, how much to repair, and when to repair. This thesis uses simulation to model the two sets of procedures and to compare their performance with respect to three formal measures of effectiveness adopted by NAVICP: Supply Material Availability (SMA), Average Delay for a Delayed Requisition (ADDR), and Average Monthly Investment Level (AMIL). The comparison results of the thesis indicate that the existing Navy inventory procedures generate better performance in all three formal measures of effectiveness.

# THESIS DISCLAIMER

The reader is cautioned that computer programs developed in this research may not have been exercised for all cases of interest. While every effort has been made, within the time available, to ensure that the programs are free of computational and logic errors, they cannot be considered validated. Any application of these programs without additional verification is at the risk of the user.

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**EXECUTIVE SUMMARY**

The Naval Inventory Control Point (NAVICP) is responsible for the procurement, repair, and management of over 375,000 spare parts. These parts are required to support the operation of ships, submarines, Naval aircraft, maintenance activities, all associated weapon systems and related test equipment. NAVICP uses the Uniform Inventory Control Program (UICP) to implement the Navy's wholesale repairable inventory control procedures. UICP characterizes a periodic review inventory process that calculates four decision variables in order for the Item Managers to manage Navy inventories. These variables represent when to buy, how much to buy, when to ship failed items to the repair facility, and how many to ship.

The Director of Planning and Operations Research Department, NAVICP Code M041, requested a study to examine the performance benefits of a set of proposed inventory control procedures for managing high-cost repairable items. These procedures are based on techniques implemented in a commercial software package known as Bandwidth Management (Stewart and Frazier, 1996). Because Bandwidth Management does not explicitly handle repairable items, this thesis proposes two sets of procedures resembling the Bandwidth Management concept of regular monthly deliveries and a periodic review process. It incorporates the same UICP procedures for the repair process. These two sets of procedures calculate three decision variables that represent how much to deliver each month, how much to repair, and when to repair.

Monte Carlo simulation is used to compare the performance of the three sets of inventory control procedures. The simulations are referred to as *UICP, BAND* and

*THIRD*. The initial inputs are taken from historical data of 240 high-cost items specified by NAVICP Code M051.

Performance of each simulation is determined by calculating three formal measures of effectiveness (MOE's) adopted by NAVICP: Supply Material Availability (SMA), Average Delay for Delayed Requisition (ADDR), and Average Monthly Investment Level (AMIL). SMA is the percentage of demands that is filled immediately; ADDR is the average number of days a demand remains unfilled; and AMIL is the holding cost of inventory and is calculated as the product of an item's replacement cost, holding cost rate, and average monthly inventory level.

The simulation results clearly indicate that the Navy's existing inventory procedures are the more favorable set of procedures to manage the Navy's high-cost wholesale repairable items. UICP exceeded both *BAND* and *THIRD* in each of the three MOEs.

Sensitivity analysis is performed to determine whether dividing the 240 items based on replacement cost would produce a category where *BAND* or *THIRD* would perform more favorably. These results proved negative. It is recommended that the Navy continue to use its existing inventory control procedures to manage its wholesale inventory.

# I. INTRODUCTION

## A. BACKGROUND

On October 2, 1995, the Navy's two Inventory Control Points, the Ship's Parts Control Center (SPCC) in Mechanicsburg, PA. and Aviation Support Office (ASO) in Philadelphia, PA combined to form a single command called the Naval Inventory Control Point (NAVICP).

Currently, NAVICP Mechanicsburg (NAVICP-Mech) is responsible for the procurement, repair, and management of over 233,000 spare parts for ships and submarines, and their associated systems. NAVICP Philadelphia (NAVICP-Phil) is responsible for the procurement, repair, and management of over 142,000 spare components applicable to Naval aircraft, aircraft weapon systems and related test equipment; see NAVICP ltr (1997).

Inventory management in the United States Navy is constantly changing and has become a very complex process over the past 20 years. Technology has increased at such a rapid pace in the design of major weapon systems that the required logistical support has become much more critical. Requirements determination is one of the most important components of logistical support. Requirements determination includes the process of reviewing inventory requirements, anticipating available assets, and deciding how much to procure and repair based on demand, system criticality, and available funding. One type of item is one that can be repaired. These items are called repairables.

Early inventory control procedures were developed for repairables and proved to be more than adequate to manage inventory in the early 1980's when funding was not a major issue. However, in recent times, funding has been greatly reduced. As a result, a

more efficient inventory control procedure is desired. The new procedure must be capable of improving customer service at a lower investment cost.

In search of better customer service at lower investment cost, the Director of the Planning and Operations Research Department, NAVICP Code M041, requested a study to compare performance and investment costs between the current NAVICP repairable inventory control system and a system similar to that of Bandwidth Management (Stewart and Frazier, 1996). This thesis responds to that request.

Inventory control systems use procedures that are based on inventory management models. Early inventory management models assume demand is constant and were developed based on the stipulation that stockouts were not allowed. After World War II, G. Hadley of the University of Chicago and T.M. Whitin of the University of California, Berkeley argued that demand was not constant but instead, a random variable. Hadley and Whitin (1963) developed an inventory model based on the concept that demand was a stochastic process and the average rate of demand remained constant over time. Their research and development helped create the principal policy for the current DoD instructions concerning procurement cycles and safety levels of stock for consumable items.

The system of computer files, programs, and reports used by NAVICP-Mech and NAVICP-Phil for inventory management is known as the Uniform Inventory Control Program (UICP). UICP was developed in 1965 to provide a standardized system for both commands to use. Fleet Material Support Office (FMSO) under Naval Supply Systems Command (NAVSUP) is responsible for system design, maintenance, ADP analysis, programming, and documentation of the UICP system (DoN, 1991).

## B. OBJECTIVE

The primary purpose for this research is to compare the current UICP procedures to proposed procedures based on those implemented in a commercial product known as Bandwidth Management (Stewart and Frazier, 1996). Monte Carlo simulation is used to compare the two procedures. The simulations use data from 240 high-cost repairables identified by Mr. Bill Howells, Deputy Director NAVICP Code M051. These items represent twenty percent of all the Depot Level Repairables (DLR's) within Code 051 and account for eighty percent of their total investment. A time event simulation has been written for each process and the associated code is available from the author at NAVICP Code M041.D. The simulations are referred to as *UICP* and *BAND*.

This thesis determines which inventory control system is more efficient and more effective for these items. The systems are evaluated in terms of three formal measures of effectiveness (MOE's) adopted by NAVICP: Supply Material Availability (SMA), Average Delay for Delayed Requisitions (ADDR), and Average Monthly Investment Level (AMIL).

The objectives of this thesis are as follows:

1. Develop two simulation models, one to simulate the NAVICP process for repairable items and one to simulate the Bandwidth process for repairable items;

2. Compare performance between the two processes; and

3. Determine which process provides better inventory control for high-cost repairables.

## C. SCOPE

Direct comparison of the two processes' using historical performance data is difficult. The main reason for this difficulty is that the inventory control process is

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influenced by external factors. For example, assets offloaded from decommissioned ships are returned to the wholesale system, increasing inventory levels to a point that surpasses the maximum limits. Assets removed from active ships due to aggressive retail inventory reduction projects also increase inventory levels. These sources of external adjustments render the data from the inventory control unsuitable to compare inventory control procedures.

The NAVICP process deals with a number of variables. Demand for asset items occur at random times and are either serviced immediately by shipping a replacement from stock or by creating a backorder if there is no item in stock. This demand may or may not be accompanied by the failed component (carcass). This carcass can either be repaired or replaced. Carcasses are placed in storage. They remain in storage until sent to a repair facility. Not all carcasses are capable of being repaired, but those that are repaired, return to wholesale stock at a fixed time later. The inventory control system has policies for deciding when and how many new material assets to order as well as when and how many carcasses to send to repair. Maher (1993) details these policies.

The Bandwidth Management process operates quite differently. It was designed solely for items that are not repairable. At the beginning, a fixed number of new assets are ordered for regular (monthly) delivery from a contractor. As time passes, the quantity in stock will vary because of variability in the demand process. It may occur that stock levels become either excessively high or dangerously low. The model is designed to "flag" these conditions through a set of control bands. If the forecasted stock levels exceed either the upper or lower band, the fixed replenishment quantity is recalculated.

Simulation is used to compare the two systems. In this way, the comparison of the two processes can be executed using a common random number stream, which allows both systems to operate with the exact same demand pattern. The problems associated with the real data are circumvented using simulation. Simulation also allows a provision to utilize the repair facility process in the monthly forecasting of stock levels for the *BAND* system. Both simulations are written using the JAVA programming language.

The comparison of both processes is made from a summary of the results of all 240 items from the simulations, and also by means of sensitivity analysis based upon the cost to replace each of the 240 items. This activity leads to consideration of an adaptation of *BAND* called *THIRD* that utilizes additional procurements to fill existing backorders. The summary results of *THIRD* are compared to *UICP*.

## D.   ORGANIZATION

Chapter II discusses the two inventory control processes. Chapters III and IV describe the *UICP* and *BAND* simulations respectively. These chapters discuss the purpose of each simulation, the assumptions made, and the structure and design of each. Chapter V describes the results from both simulations and the analysis of those results and introduces *THIRD*. All MOE's are compared and critical analyses are performed to determine which inventory process is more efficient and effective. Chapter VI summarizes the thesis research, identifies the better procedure, offers recommendations to the NAVICP, and discusses possible further work suggested as a result of this study.

## II.    THE INVENTORY CONTROL PROCESSES

It is important to understand the two wholesale repairable inventory control procedures being compared in this thesis and the concepts on which they are based. This chapter discusses the current NAVICP procedures and the proposed Bandwidth procedures. The final section in the chapter discusses discrete event simulation implemented in JAVA.

The two inventory control procedures are compared based on three measures of effectiveness (MOE's) for each item. The measures are defined as follows:

*SMA:*    *The percentage of demands that could be filled immediately.*
*SMA*  =  *(Number of First Time Issues/Number of Total Demands)*    **(1)**


*ADDR:*    *The average number of days a demand remains unfilled.*
*ADDR*  =  *(Total Waiting Time Of All Backorders/*
*Total Number of Backorders)*    **(2)**


*AMIL:*    *The cost associated with holding inventory in stock*
*AMIL*  =  *The product of the cost to replace the item, the variable holding*
*rate (I), and the average monthly inventory level.*    **(3)**

*First Time Issues* refer to the immediate satisfaction of a demand request. *Total Demands* refer to the total number of demands that occur during the entire period of study. *Total Time of All Backorders* is the cumulative sum of waiting times in backorder for each demand placed in backorder status during the entire period of study. *Total Number of Backorders* is the total number of demands that were placed in backorder status during the entire period of study. The variable holding rate (I) sums the relative costs associated with capital, obsolescence, and storage. This rate is often expressed as a fraction or percentage of unit cost per year, i.e., the cost of holding one-dollar's worth of material in inventory for one year (Robillard 1994). For repairable items, NAVICP uses

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the values 0.10 for capital (time preference), 0.10 for obsolescence, and 0.01 for storage costs.

It is possible that a failed item does not accompany the demand for a replacement item. The probability that a failed item, or carcass, will accompany the demand is referred to as the Carcass Return Rate (CRR) (Baker 1994). Additionally, the repairing facility will assess each item received and determine if it is capable of repair. The probability of repair for these items is referred to as the Repair Survival Rate (RSR).

An attrition is said to have occurred either when a failed item is not returned to the Item Manager (IM), or is assessed as not capable of repair by the repair facility. A procurement action is required to replace attritions in order to maintain the required inventory level.

When an item fails, a demand for a replacement item is generated. The failed item, if returned, is shipped back to the IM for repair or condemnation. The beginning of the repair cycle occurs when the failed items are received by the repairing facility. The cycle ends after the items are repaired by the repair facility and returned to the supply system as a Ready For Issue (RFI) asset. This period of time is referred to as the Repair Turnaround Time (RTAT) and is treated in this thesis as deterministic.

## A. NAVICP PROCEDURE

The current wholesale repairable inventory control procedures are implemented in the Uniform Inventory Control Program (UICP). The purpose of this program is to determine how many new assets to buy, when to buy them, how many Not-Ready-For-Issue (NRFI) items to repair, and when to repair them. The program minimizes the annual total variable costs (Robillard, 1994).

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The procedures in the UICP program are based on a periodic review inventory model that forecasts demand (D) for the upcoming quarter and computes associated levels based on that forecast. The mathematical derivations for the variables associated with the procurement and repair processes are discussed in detail in Maher (1993).

## 1. Procurement Process

A procurement decision for a particular item is based on three decision variables: Reorder Level (R), Order Quantity (Q), and Inventory Position (IP).

$$R = \text{Expected number of demands for the item a NAVICP defined "average acquisition time" plus a safety level} \tag{4}$$

$$Q = \text{Order quantity for the quarter} \tag{5}$$

$$IP = \text{On Hand + On Order + (NRFI carcasses * RSR) – Backorders} \tag{6}$$

where

| | | |
|---|---|---|
| On Hand | = | current number of RFI items in inventory |
| On Order | = | number of items on order due to be delivered within a procurement lead time. |
| NRFI Assets | = | total number of Not Ready for Issue (NRFI) carcasses waiting at the holding facility for repair plus the number of those NRFI carcasses currently being repaired by the repair facility. |
| RSR | = | probability that a NRFI carcass can be repaired by the repair facility. Referred to as Repair Survival Rate. |
| Backorders | = | the number of backorders for the item that exist. |

The *safety level* is an additional level of stock used to reduce the probability of a stockout. Procurement lead time (L) or PCLT is the time interval beginning with the placement of an order by the IM and ending when that order arrives and is placed in wholesale stock. The IP is checked monthly and a procurement action is initiated if the IP falls below R.

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## 2. Repair Process

A repair decision for an item is based on the following variables: Repair Level ($R_2$) and Available Assets (AA). The repair decision sends a number of failed items from the holding facility to the repair facility.

$R_2$ = *Expected number of demands during a repair time (RTAT)*
*plus the safety level* (7)

*AA* = *On Hand + Orders Due In + Repairs Due In - Backorders* (8)

where

| | | |
|---|---|---|
| *On Hand* | = | *current number of RFI items in inventory* |
| *Orders Due In* | = | *number of items on order which are due to be available within an RTAT.* |
| *Repairs Due In* | = | *number of NRFI carcasses currently being repaired by the repair facility due to be available within an RTAT.* |
| *Backorders* | = | *the number of backorders for the item that exist.* |

Each time a carcass accompanies a demand for its replacement, the carcass queue is increased by one. A value for AA is computed semi-monthly and a repair action is initiated if AA falls below $R_2$. The deficit is shipped (inducted) immediately to the appropriate repair facility. These carcasses are repaired and returned an RTAT later.

## B. BANDWIDTH PROCEDURE

The proposed wholesale repairable inventory control procedure is based on a procedure implemented in a commercial product known as Bandwidth Management (Stewart and Frazier, 1996). The proposed procedure is for items that are not repairable. It is a monthly review, periodic delivery inventory system. It determines a fixed monthly procurement quantity to be delivered by the contractor and establishes a control band based on historical demand data. Intervention by the IM is not required unless the

cumulative demand observations fall outside the designated upper or lower bounds of the control band.

## 1. Procurement Process

In the Bandwidth process, R, Q, and IP are not utilized and hence not calculated. Instead, a monthly delivery quantity (DELQTY) is computed as the product of the monthly forecast demand (D) and the wearout rate (W):

$$DELQTY = DW \tag{9}$$

where
$D = Monthly\ Forecast\ Demand$
$W = 1 - CRR \cdot RSR$

where

| | | |
|---|---|---|
| CRR | = | *probability that a failed item (carcass) is delivered to a holding location. Referred to as Carcass Return Rate.* |
| RSR | = | *probability that a NRFI carcass can be repaired by the repair facility. Referred to as Repair Survival Rate.* |

## 2. Repair Process

The repair decision in the Bandwidth process is conceptually the same as the UICP process. However, repair level (REPAIRLEVEL) and available assets (ASSETS) are computed differently. Instead of calculating the repair level based on demands during repair turnaround time, it is calculated based on the number of carcasses that can be returned from the repair facility during the upcoming month plus a safety level. The safety level is computed as twice the square root of the expected number of regenerated items that can be returned from the repair facility during the upcoming month. The REPAIRLEVEL is calculated as the sum of the mean and the safety level.

$$REPAIRLEVEL = Expected\ Number\ of\ Regenerated\ Items + Safety\ Level \tag{10}$$

where

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$$Expected\ Number\ of\ Regenerated\ Items = D \cdot CRR \cdot RSR$$

$$Safety\ Level = 2\sqrt{Expected\ Number\ of\ Regenerated\ Items}$$

where

| | | |
|---|---|---|
| $D$ | = | *Monthly Forecast Demand* |
| $CRR$ | = | *probability that the failed item (carcass) will accompany a demand. Referred to as Carcass Return Rate.* |
| $RSR$ | = | *probability that a NRFI carcass can be repaired by the repair facility. Referred to as Repair Survival Rate.* |

Available assets are computed in a similar manner as in **UICP**. The quantity DELQTY is used in place of order quantity.

$$ASSETS = \quad On\ Hand + DELQTY + RFI\ DUE\ IN - Backorders \qquad (11)$$

where

| | | |
|---|---|---|
| *On Hand* | = | *current number of RFI items in inventory* |
| *DELQTY* | = | *monthly number of items delivered.* |
| *RFI DUE IN* | = | *number of NRFI carcasses currently being repaired by the repair facility due to be available within the upcoming month.* |
| *Backorders* | = | *the number of backorders for the item that exist.* |

As with the Navy's model, the carcass queue is increased by one if a carcass accompanies a demand. Additionally, ASSETS is calculated twice a month. If ASSETS falls below REPAIRLEVEL, then the difference is inducted immediately to repair and returned as wholesale stock in a time period RTAT later.

## C. DISCRETE EVENT SIMULATION

To analyze the performance of both the NAVICP process and the Bandwidth process, the author develops a time event simulation program for each. The NAVICP simulation is referred to as **UICP**, and the Bandwidth simulation is referred to as **BAND**. Both simulations are written using the JAVA programming language. Both models utilize the program SIMKIT, developed by Professor Arnold Buss and LT Kirk Stork at the Naval Postgraduate School (Buss and Stork, 1997). The simulation technique is

chosen since it is the most economic and realistic way to represent an inventory process and analyze its performance over a period of time, given a specific demand stream, certain input variables, assumptions and constraints. Simulation also allows the user to specify several system parameters and profiles.

Both simulations model the inventory management of a repairable item for 660 months. Demand for an item is generated in the following manner. The monthly mean and standard deviation for each item are computed from 60 months of historical observations. Display of the historical moments appears in Appendix A.

The monthly demands for an item are simulated as follows: The first step is to generate demands for each month. The number of demands in each month are assumed to be independent and identically distributed. If the historical mean monthly demand for the item is less than one-third, then the number of demands in a month is modeled as independent Poisson random variables with the mean being the historical monthly mean. If the historical monthly mean is greater than or equal to one-third, then the number of demands in a month is drawn from a normal distribution using the historical mean and standard deviation. If the generated normal random number is negative, the demand is set equal to zero. If it is positive, the closest integer to the number is taken as the number of demands. To validate the procedure, the monthly mean and standard deviation of the simulated demands is computed for each item over 600 months. Ten replications are run for each item and the mean of the monthly means and the mean of the standard deviations is computed. The results for each item are compared to the monthly mean and standard deviation of the historical data for the same corresponding item. Appendix B illustrates

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the strong correlation between the simulated means and historical means, as well as the strong correlation between the simulated and historical standard deviation.

A simulation is implemented in the programming language JAVA. The simulation operates from a master appointment list of scheduled events referred to as the "event list." It is called an event list because at any given time, it contains all events, which have been scheduled, and the times they are to be executed. Once the simulation starts, the simulation time will advance to the next scheduled event on the list. Occasionally, some future events are inserted into the list as a result of the simulation. The process continues until the simulation time reaches the finish time specified by the user. A general flow chart summarizing this process is illustrated in Figure 1.
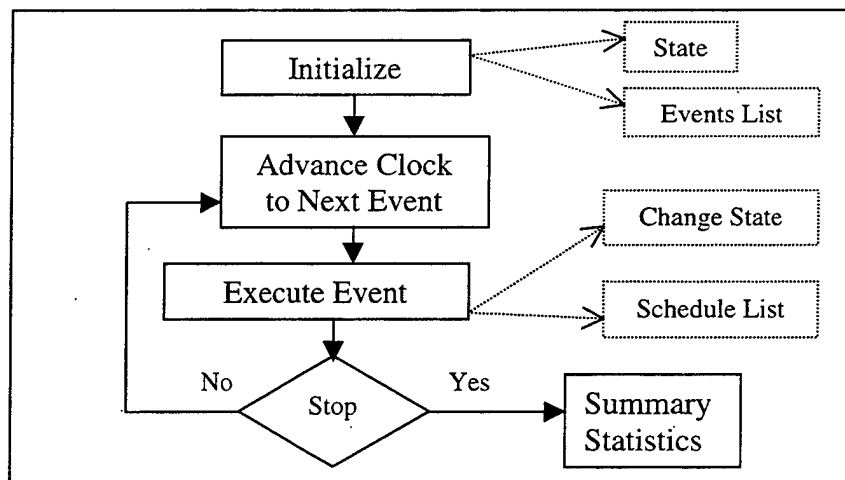


**Figure 1. Main Event-Scheduling Algorithm**

# III.   UICP SIMULATION

The first part of this chapter discusses the *UICP* simulation and its assumptions, followed by the structure and design of the simulation.

## A.   DISCUSSION

The initial parameters provided to *UICP* by the user are listed in Appendix C, together with a definition for each.

As discussed in Chapter II, if the historical mean quarterly demand for the item is less than one, the time between demands is assumed to be exponentially distributed with mean being one-third of the historical quarterly mean. A random number is generated from the exponential distribution whose parameter is the reciprocal of the monthly demand mean. These numbers representing inter-arrival times are sequentially added to the event list to establish the arrival time of each demand.

If the historical monthly mean is greater than or equal to one-third, then the number of demands in a month is drawn from a normal distribution with the historical mean and standard deviation. If the random number is negative, it is set equal to zero. If it is positive, the closest integer to the number is taken as the number of demands. Monthly demand quantities are determined as previously discussed. The arrival time of each demand for an item within a month is determined using a draw from a uniform distribution [0,1]. This generated value represents the arrival time (in units of a month) of a demand for an item during a month and is added to the event list.

### 1.   Assumptions

The *UICP* model utilizes many of the same assumptions as Maher (1993). The model assumptions are listed below.

1. The numbers of demands in each month are random, with a constant mean, variance, and probability distribution, which do not change over time.

2. Every time an item fails, it creates a demand.

3. Carcass Return Rate (CRR), Repair Survival Rate (RSR), Procurement Lead Time (PCLT), and Repair Turnaround Time (RTAT) are known and constant for each National Item Identification Number (NIIN).

4. All demands have the same priority and are filled in the order of arrival time.

5. A *First Time Issue* is made immediately if on-hand inventory exists when the demand occurs. Otherwise, the demand is placed in a first-in first-out (FIFO) backorder queue.

6. All backorders have the same priority and are filled immediately when assets become available.

7. A NRFI carcass is determined to accompany a demand if the value of an independently generated random uniform between 0 and 1 is less than or equal to the CRR value.

8. If a carcass exists, a turn-in to the holding activity occurs instantaneously.

9. The Inventory Position (IP) value changes with each demand, reorder of new material, and the total number of NRFI carcasses.

10. Carcasses are inducted into the repair system in batches. The quantity inducted is multiplied by RSR to determine the number to be successfully repaired. This assumes that a percentage cannot be repaired by the repairing facility.

11. Once a batch of NRFI carcasses begins repair, the batch is returned as Ready-For-Issue (RFI) assets after a constant repair time.

12. There is no congestion at the repair facility. Repairs begin immediately once they are shipped to the repair facility.

13. Purchases are received at the supply center sequentially in the order their orders were placed.

14. Procurement of the order quantity is not constrained by budget restrictions.

15.	Assets assigned to Planned Program Requirements (PPR) or War Reserves are not considered in this model when computing the on-hand inventory level, or the on-order level.

16.	If a Supply Demand Review (SDR) is scheduled during a month when quarterly levels are being computed, it is scheduled after that computation.

## B.	SIMULATION STRUCTURE AND DESIGN

All formulas within the routines used in *UICP* were derived from the concepts and ideas of Hadley and Whitin (1963) and discussed by Maher (1993). As previously discussed in Chapter II, the event list determines what event occurs and when. The "main event list" is a time sequencing of four anticipated processes. The flowchart in Figure 2 illustrates the scheduling of five main events in the simulation. Three of the five events occur at fixed times: (i) "D01", a quarterly review of levels process; (ii) "B08", a semi-monthly review to determine if repairs are required; and (iii) "B10", a monthly review to determine if the purchase of new material is required. The fourth event, "Demand", inserts the time of the random demands properly into the time sequences of the event list. The fifth event, "Receipt of Assets", includes two processes, receipt from repair and receipt from order. These are inserted at random as a result of the simulation, but are treated together as a single main event. See Figure 2.

Within each of the main events, there are numerous "sub-events" which can be randomly scheduled. The flow charts in Figures 3 through 6 illustrate the process for each of the main events depicted in Figure 2. The flowchart in Figure 7 shows the process when either items are received from the repair facility after completing repair, or an order is received from the contractor.

17
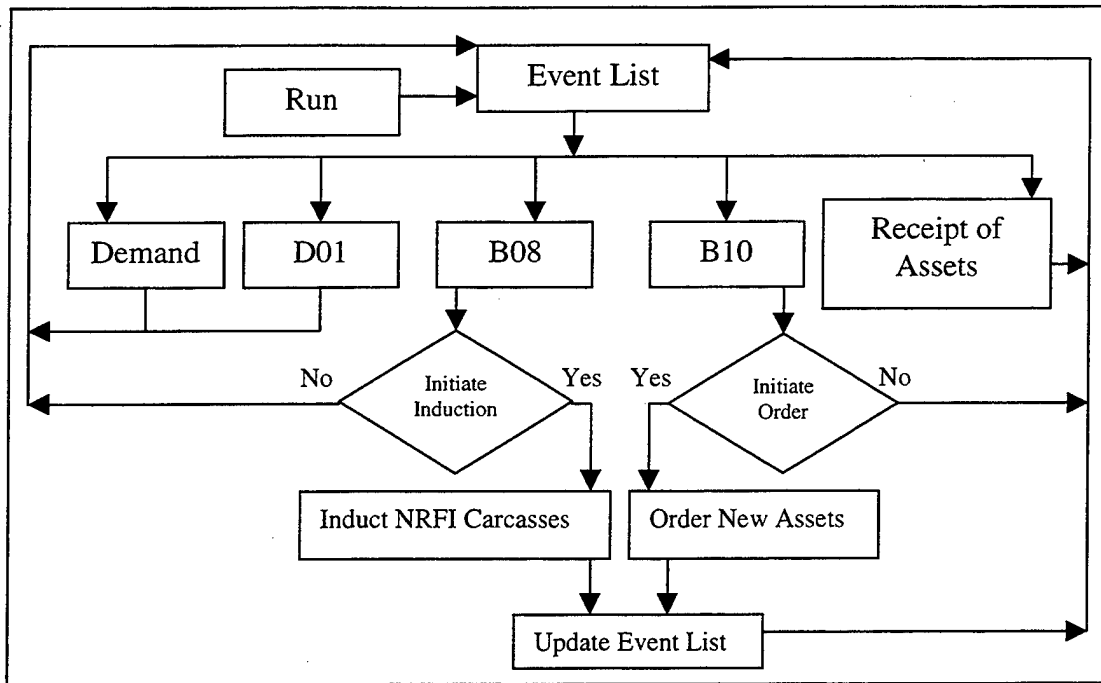
**Figure 2. Main Event List For *UICP***

### 1. Demand

If the current event on the event list is a demand, it is removed from the event list and executed. The current inventory level is checked to determine if there is an asset available to fill the demand. If so, an issue is made and *First Time Issues* is incremented by one and the inventory level is decreased by one. If there are no assets available, the demand is placed in backorder and the *Total Number of Backorders* is increased by one. The time associated with the backorder is recorded so that the time in backorder status can be computed once the backorder is filled.

After the demand occurs, a random draw determines whether an NRFI carcass accompanies the demand. If so, the NRFI queue is increased by one to await shipment to the repair facility. If no carcass accompanies the demand, no action is taken. The model then returns to the event list.

18
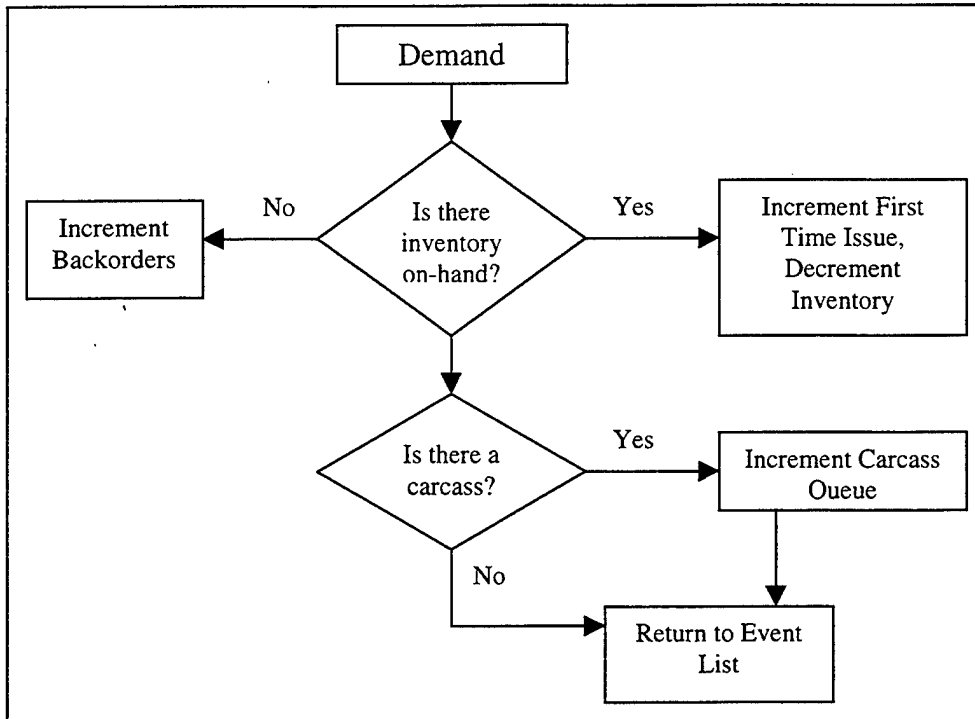
**Figure 3. Demand Event Process**

## 2. D01 (Levels Setting Process)

All the demands for one item occurring over the past three months are summed to compute the quarterly demand. It is compared to the forecasted demand for that same period. The forecasting process is outlined in DoN (1991) and Urban (1993). It includes a filtering process, and a trend detection technique. The process is illustrated in Figure 4.
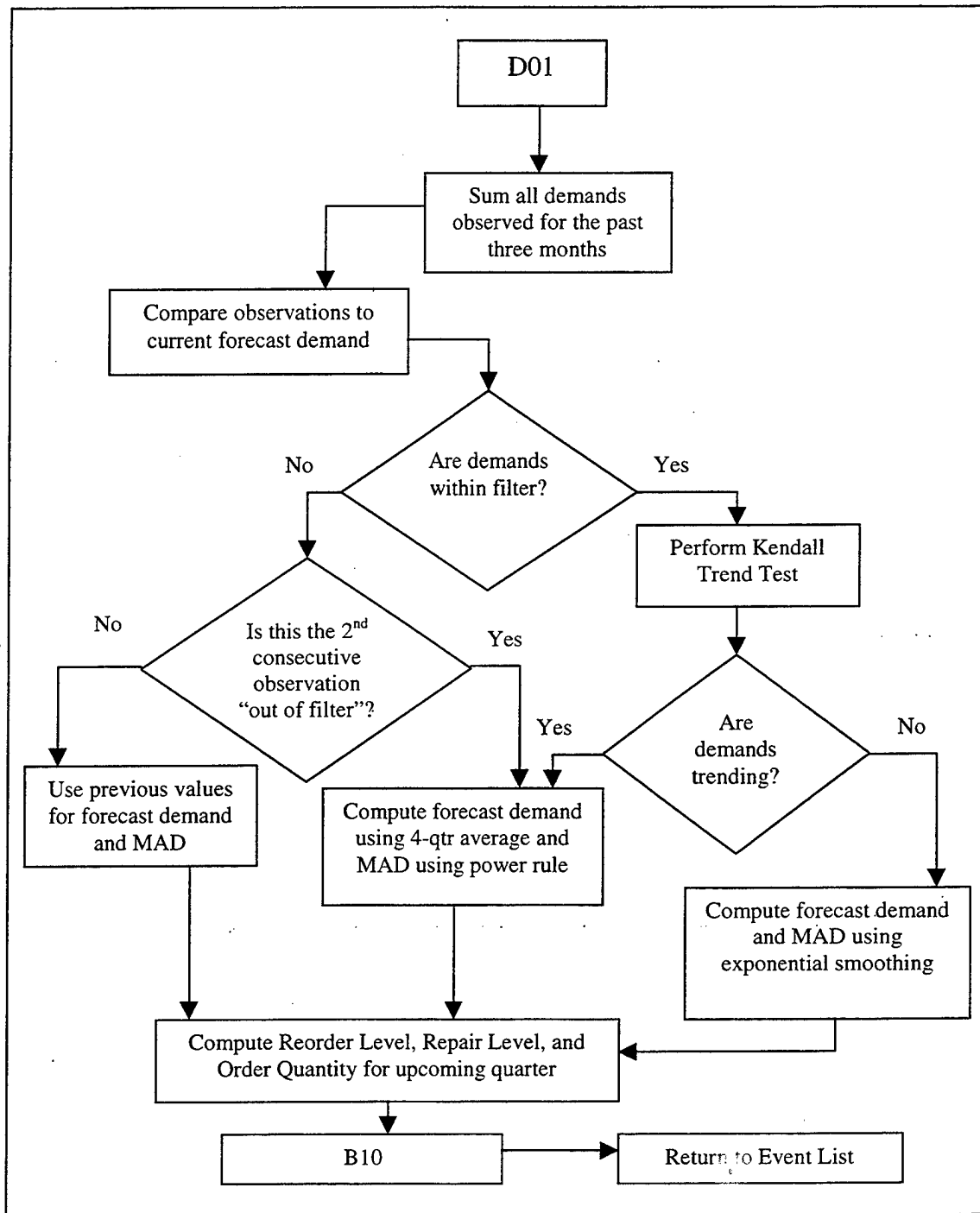
**Figure 4. D01 (Levels Setting) Event Process**

The *UICP* model uses a single exponential smoothing (Urban 1993) technique to forecast quarterly demand and the Mean Absolute Deviation (MAD) of demand, (Urban 1993). Currently, a smoothing constant of 0.1 is used. Depending on the results of the filtering process and the Kendall test, the simulation may branch to a mathematical algorithm known as the power rule (DoN 1991). This algorithm is used in place of exponential smoothing.

The filtering process is the first step performed in the forecasting process. Prior to computing the next quarterly demand forecast, the observed demand from the most recent quarter is analyzed to determine if it falls within certain limits. As Robillard (1994) discusses, this process is referred to as "step" filtering and determines if there has been a significant change in the mean. A significant change in the mean is defined to be two consecutive demand observations either exceeding an upper control limit or failing to meet a lower control limit. If either case occurs, the forecast is computed as the average of the four most recent observations; the power rule algorithm is used to compute the forecasted MAD. If only the most recent observation is out of the control limit, the demand and MAD forecasts are not updated. If the most recent observation is within the control limits, then a trend detection test developed by Boyarski and Bissinger (1990) is performed.

The trend test algorithm consists of a statistical test using a "window" to determine if the demand is trending (Robillard 1994). The size of the "window" is a function of the mean and variance of the demand. In turn, the statistical test depends upon the window size and variability for the demand. If a trend is detected, the next quarter's demand forecast is computed using a four-quarter average, and the MAD is

computed using the power rule algorithm. The exponential smoothing technique is used for the follow-on quarters provided the filter and trend tests are passed, as discussed.

Once the quarterly demand and MAD forecasts have been computed for the upcoming quarter, levels must be reset. This requires the computation of the constrained Order Quantity ($\hat{Q}$), constrained Reorder Level ($\hat{R}$), and constrained Repair Level ($\hat{R}_2$) for each quarter. At the NAVICP, the levels setting program PD-82 (McNertney and Reynolds, 1993) is used to determine these levels.

There is a two-step process involved with calculating these values. First, a value is computed using formulas derived in Maher (1993). These values are then compared with a series of limitations and then adjusted, resulting in a "constrained" value. These constraints apply a minimum and maximum value to the associated levels.

Prior to computing $\hat{Q}$, $\hat{R}$, and $\hat{R}_2$, the probability of a stockout (referred to as RISK) and the number of demands that occur during a NAVICP defined "average acquisition" time (referred to as Procurement Problem Variable or Z) is computed (DoN, 1991).

### a. RISK

The original *RISK* equation was developed from the Total Variable Cost (TVC) equation as shown by Maher (1993). NAVICP assumes lead time demand is large enough to use the Normal distribution for approximating the Poisson distribution. To ensure the calculated procurement level provides sufficient carcasses to meet the requirement set by the repair level, NAVSUP developed an integrated *RISK* formula to compute the safety level used in the computation of $\hat{R}$ and $\hat{R}_2$. The formula is,

$$RISK = \frac{DIC_3}{DIC_3 + \lambda FE} \tag{12}$$

where

$C_3 \quad = \left(\frac{G}{D}\right)(C_2) + \left(1 - \frac{G}{D}\right)(C)$

$D \quad$ = *forecast of quarterly demand*

$I \quad$ = *holding rate (capital + obsolescence + storage costs).*

$G \quad$ = *quarterly regeneration forecast of ready for issue items from the repair facility.*

$C_2 \quad$ = *cost to repair one unit*

$C \quad$ = *unit price of the item*

$E \quad$ = *mission essentiality code (usually one)*

$F \quad$ = *average number of items in a request from the fleet.*

$\lambda \quad$ = *shortage cost per request (constant value for each item).*

**b.      Procurement Problem Variable (Z)**

In a model that incorporates a repair process, a percentage of those demands during a procurement lead time will have a number of associated NRFI carcasses that can be fully repaired or regenerated (G) within that same lead time. The NAVICP has defined this concept as the demand during an "average acquisition" time and called it the Procurement Problem Variable. Its formula is,

$$Z = DL - GL + GT, \tag{13}$$

where

$G \qquad\qquad$ = *quarterly regeneration of ready for issue items from the repair facility.*

$L \qquad\qquad$ = *procurement lead time in quarters*

$T \qquad\qquad$ = *Repair Cycle Time*

*Repair Cycle Time* = *RTAT + Time between repair cycles*

*Time between repair cycles* = *0.19 quarters*

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c. **Constrained Order Quantity ($\hat{Q}$)**

The Economic Order Quantity (EOQ) is obtained from minimizing the total variable cost (TVC) equation with respect to Q (Maher 1993). The result is an initial order quantity, Q*,

$$Q^* = \sqrt{\frac{8(D-G)A}{IC}}$$ (14)

where

| | |
|---|---|
| $A$ | $= administrative\ costs\ associated\ with\ an\ order$ |
| $D$ | $= forecast\ demand\ for\ quarter$ |
| $G$ | $= quarterly\ regeneration\ of\ ready\ for\ issue\ items\ from\ the\ repair\ facility.$ |
| $C$ | $= unit\ price\ of\ the\ item$ |
| $I$ | $= holding\ rate\ (capital + obsolescence + storage\ costs).$ |

Equation (14) can result in an extremely high or low value. To protect against this, NAVICP constrains Q*. The first set of constraints applied to Q* ensures that the order quantity does not exceed one and a half years of attrition demand and is not less than 6 months worth of attrition demand. (Attrition demand is the difference between total demands and the number of those demands that could be regenerated). It also ensures that at least one asset is ordered. Its application is,

$$\tilde{Q} = min\left\{ \begin{matrix} 6(D-G) \\ max\left\{ \begin{matrix} Q^* \\ K_0(D-G) \\ 2(D-G) \end{matrix} \right\} \end{matrix} \right\} + 0.5$$ (15)

where

| | | |
|---|---|---|
| $(D-G)$ | $=$ | $attrition\ demand.$ |
| | | $those\ demands\ that\ had\ no\ accompanying\ carcass$ |
| | | $or\ that\ could\ not\ be\ repaired\ by\ the\ repair\ facility.$ |
| $K_0$ | $=$ | $NAVICP\text{-}set\ value\ to\ ensure\ the\ minimum\ order$ |
| | | $quantity\ is\ at\ least\ one.$ |

$\tilde{Q}$ is then constrained to ensure that on-hand RFI assets do not deteriorate due to shelf life. Its application is,

$$\hat{Q} = min \left\{ \begin{array}{l} \tilde{Q} \\ 4(D - G)H - max \left\{ \begin{array}{l} 0 \\ \hat{R} - Z \end{array} \right\} \end{array} \right\} + 0.5 \tag{16}$$

where

| | | |
|---|---|---|
| $\hat{R}$ | = | *constrained reorder level* |
| $Z$ | = | *net demand during lead time* |
| $H$ | = | *shelf life* |

### d.    Constrained Reorder Level ($\hat{R}$)

As discussed in Chapter II, the unconstrained reorder level, R, is the net demand during an "average acquisition" time plus a safety level:

$$R = Z + t\sigma_{DLR}, \tag{17}$$

where Z is the Procurement Problem Variable (equation 13), $\sigma_{DLR}$ is the standard deviation of the Procurement Problem Variable Variance (PPVV) discussed below (equation 20), and $t$ is the standard normal deviate associated with the computed *RISK*, (equation 12). The value $t$ is computed using the approximation formula found in McNertney and Reynolds (1993) and provided as equation 19.

$$\sigma_{DLR} = \sqrt{PPVV} \tag{18}$$

$$t = n - \left\{ \frac{A_0 + A_1 n + A_2 n^2}{1 + B_1 n + B_2 n^2 + B_3 n^3} \right\} \tag{19}$$

where    $n = \sqrt{-2ln(RISK)}$
$A_0 = 2.515517$
$A_1 = 0.802853$
$A_2 = 0.010328$
$B_1 = 1.432788$

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$B_2 = 0.189269$

$B_3 = 0.001308$

The Procurement Problem Variable Variance $\left(\sigma^2{}_{DLR}\right)$ is computed using the formula developed by Bissinger (1995).

$$PPVV = \begin{Bmatrix} \left\{\left(1 - R_1 R_2\right)^2 \left[L\sigma_D{}^2 + D^2 \sigma_L{}^2\right]\right\} + \\ \left\{\left(R_1{}^2 R_2{}^2\right) \left[T\sigma_D{}^2 + D^2 \sigma_T{}^2\right]\right\} + \\ \left\{\left(2R_1 R_2\right)\left(1 - R_1 R_2\right)\left[LT\sigma_D{}^2\right]\right\} \end{Bmatrix} \qquad (20)$$

where

$R_1 =$   *probability that the failed item (carcass) will accompany a demand. Referred to as Carcass Return Rate (CRR).*

$R_2 =$   *probability that a NRFI carcass can be repaired by the repair facility. Referred to as Repair Survival Rate (RSR).*

$L =$   *Procurement Lead Time (PCLT)*

$T =$   *Repair Cycle Time (RCT)*

$\sigma^2{}_D =$   *Forecasted Demand Variance (1.57\*MAD$^2$)*

$\sigma^2{}_L =$   *PCLT Variance (constant value)*

$\sigma^2{}_T =$   *RCT Variance (constant value)*

The first step for constraining the reorder and associated safety level is to constrain the *RISK* factor, equation (12). The constrained $R\hat{I}SK$ equation is written:

$$R\hat{I}SK = min\{maxallowableRISK, [max(RISK, minallowableRISK)]\}. \qquad (21)$$

The maximum allowable *RISK* factor is used to ensure a low probability of stock-out on high-demand items. A value of 0.35 is used when the average requisition frequency for the item is greater than or equal to one per quarter. Otherwise, a value of 0.5 is used. Conversely, the minimum allowable *RISK* factor ensures there is not an extremely large safety level, particularly on low cost items. This value is always 0.05.

The second step in computing the reorder level is to ensure that the constrained reorder point is at least one by implementing a NAVICP-set Numeric Stockage Objective (NSO), and no less than a NAVICP-set percentage of the Procurement Problem Variable. Additionally, the safety level is constrained to a level where it does not exceed the amount that will be used during the shelf life (H) of the item. The constrained reorder level $\hat{R}$ is calculated as follows:

$$\hat{R} = max \begin{cases} NSO \\ K_1 Z \\ min \begin{cases} Z + t\sigma_{DLR} \\ Z + (D - G)(4H - K_0) \end{cases} \end{cases} \tag{22}$$

where

$NSO = $        *NAVICP-set value for low demand items to ensure a minimum stockage level (usually one)*

$K_1 = $        *NAVICP-set value to ensure the safety level and reorder level do not fall below a $(1-K_1)$ percentage of the Procurement Problem Variable (equation 13).*

e.     **Constrained Repair Level ($\hat{R}_2$)**

The final level computed is the repair level, which is the expected number of demands during a repair cycle. It is used to determine if carcasses in the holding area need to be shipped to the repair facility. The unconstrained repair level is computed as the net demand during RTAT ($Z_2$), plus the safety level. NAVICP computes the safety level as the difference between $\hat{R}$ (equation 22) and Z (equation 13). This is equivalent to the safety level calculated using equation (17).

$$\hat{R}_2 = Z_2 + \left(\hat{R} - Z\right) \tag{23}$$

The constrained repair level ($\hat{R}_2$), is computed using the following equation:

$$\hat{R}_2 = max \left\{ \begin{array}{l} NSO \\ K_1 Z_2 \\ min \left\{ \begin{array}{l} R_2 \\ 4DH + Z_2 - 1 \end{array} \right\} \end{array} \right\} + 0.5 \qquad (24)$$

where

$K_1Z_2$ = *NAVICP-set constraint to ensure the safety level is constrained to a percentage of the forecasted demand and on-hand assets.*

### 3. B08 (Review Repair)

The B08 routine is scheduled semi-monthly. If AA (equation 8) is less than $\hat{R}_2$ (equation 24), then NRFI carcasses must be shipped to the repairing facility for repair. The actual quantity shipped to the repair facility is the deficit between AA and $\hat{R}_2$, divided by the repair survival rate (RSR). As discussed in the assumptions, if there are insufficient NRFI carcasses available, then all on-hand NRFI carcasses are shipped. The quantity in the carcass queue is updated by subtracting the quantity shipped from the total number of carcasses in the queue. The sum of an RTAT and the current simulation time represents the arrival time of the repaired assets from the repair facility. The event list is updated with the anticipated arrival of assets at the computed time. See Figure 5.
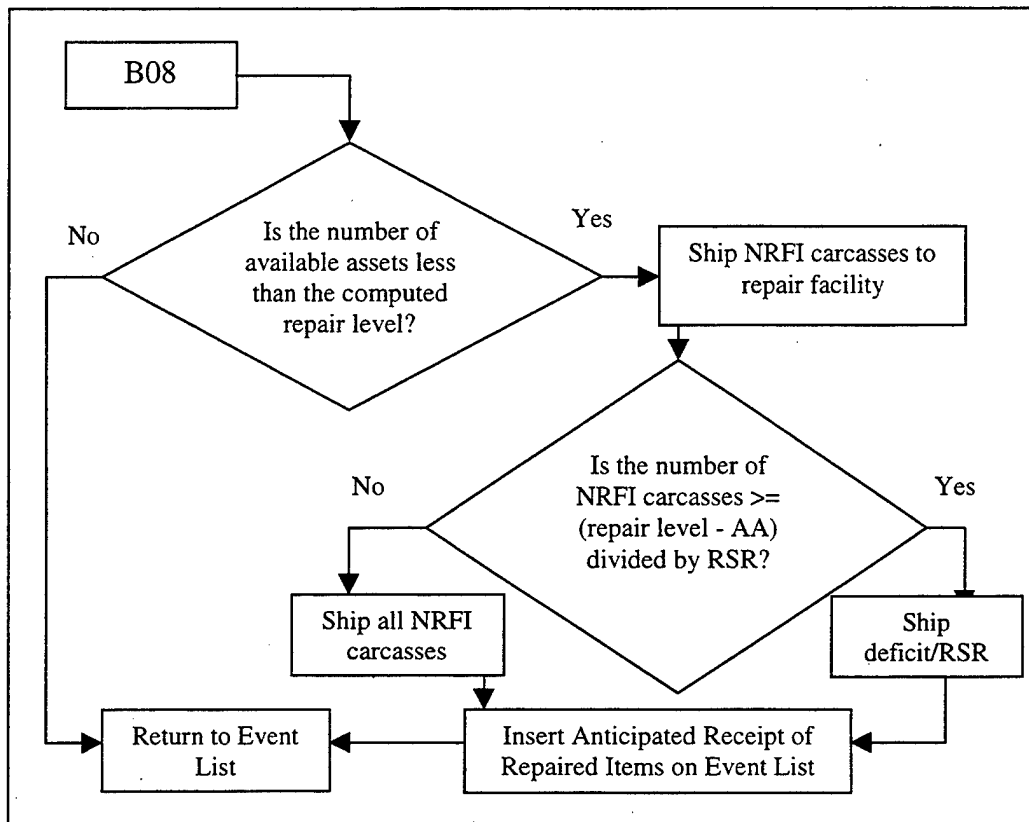
**Figure 5. B08 (Review Repair) Event Process**

### 4. B10 (Supply Demand Review)

The B10 or Supply Demand Review (SDR) routine is scheduled monthly. As discussed in the assumptions, if it is scheduled during a month when the decision variables (levels) are reset, then this routine is run immediately after this action and not before. The purpose of this routine is to determine if adequate assets are available throughout the repair pipeline to support forecasted demand. If IP (equation 6) is less than $\hat{R}$ (equation 22), then a procurement action is initiated. The quantity ordered is $\hat{Q}$ (equation 16), plus the difference between IP and $\hat{R}$. The SDR process is illustrated in Figure 6.

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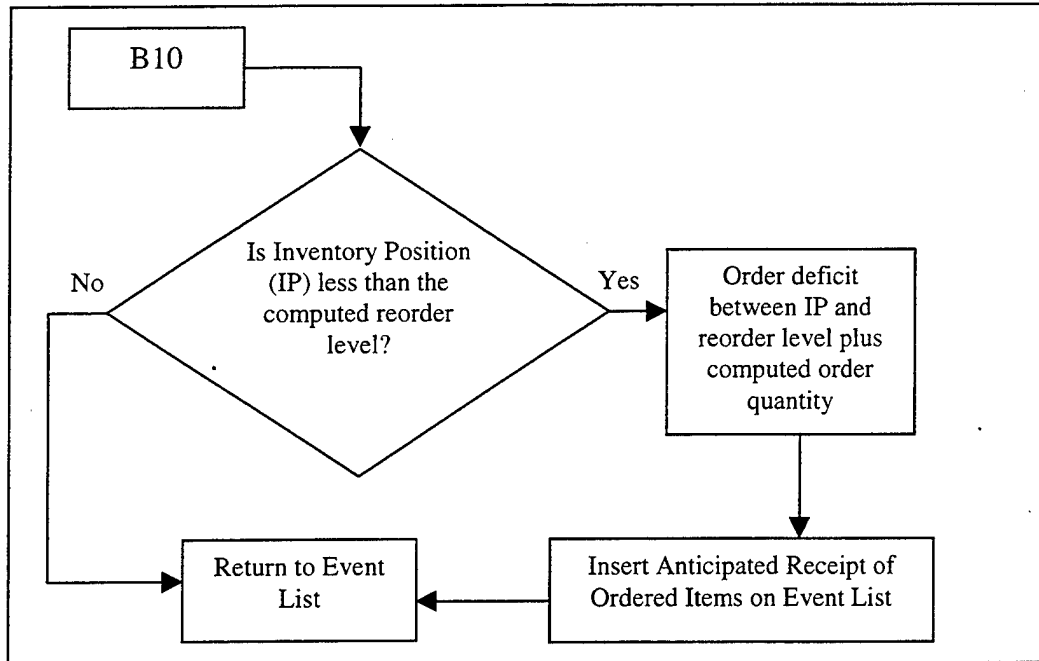
**Figure 6.  B10 (Supply Demand Review) Event Process**

### 5.      Receipt of Assets

When a repair or order is made, the time of receipt of the repaired or ordered item is anticipated and inserted into the event list.  The processing of the receipt begins with the updating of the inventory level account.  When assets are received, the inventory level is incremented by the quantity received.  The model then determines if there are any backorders in the system.  If so, the oldest backorder (first in the queue) is removed and filled.  At the same time, the inventory level is decreased by one.  The simulation time is recorded and the difference is calculated between that time and the time the demand entered backorder.   This difference represents the time that demand remained in backorder status. The model then determines if a positive inventory level still exists and if there are more demands in backorder.  If so, the process repeats.  This process

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continues until either there is no longer a positive inventory level, or there are no more

demands in backorder. See Figure 7.
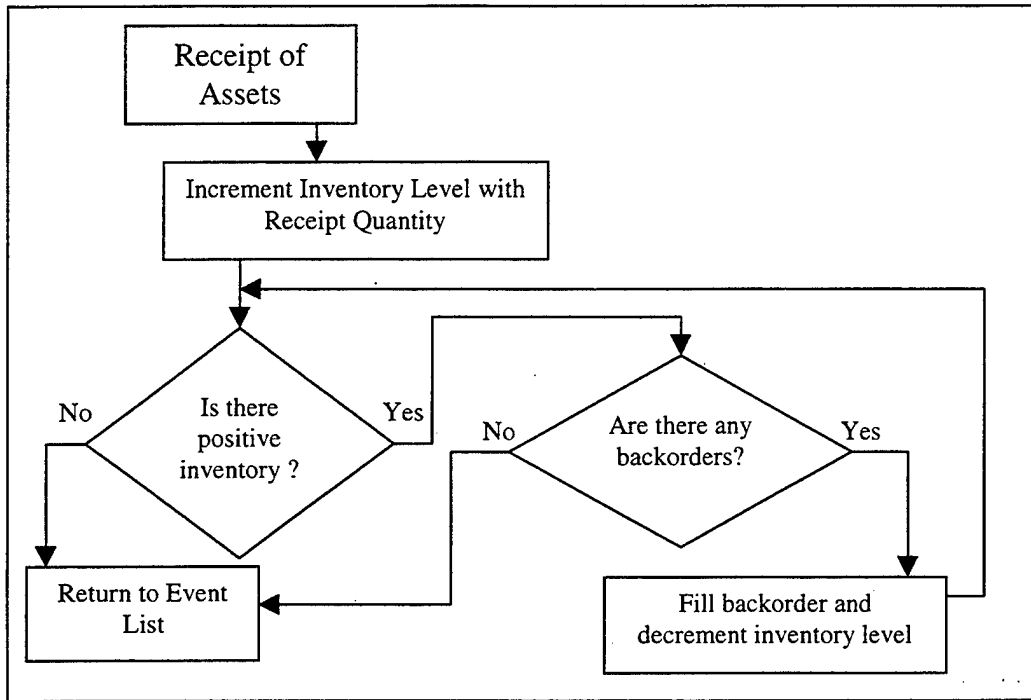


**Figure 7. Receipt of Assets Process**

## IV. BAND SIMULATION

The beginning of this chapter discusses the background associated with the *BAND* simulation. The remainder of the chapter is similar to the structure in Chapter III. It discusses the *BAND* simulation and assumptions, followed by the structure and design of the simulation.

### A. BACKGROUND

Recall this concept calls for the determination of a monthly procurement quantity based on historical demand and establishing a long-term contract with the company to have that quantity delivered every month. The simulation developed for this thesis includes the modeling of the items which can be repaired, unlike the process described in Stewart and Frazier, 1996.

### B. DISCUSSION

Input parameters provided by the user to *BAND* are contained in Appendix C, along with their associated definitions.

As with *UICP*, demands are generated based on the mean and standard deviation of the historical demand data. The demand generating process is the same as discussed for *UICP*.

#### 1. Assumptions

The same assumptions discussed in Chapter III apply to this model. Additionally, the following assumptions are specific to *BAND*, as a result of incorporating the repair process:

1. The confidence interval (CI) for the control band is plus and minus two standard deviations of the mean demand. It is the same CI used by the filter process in *UICP*.

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2. Forecasted demand, repair level, and delivery quantity are computed monthly (instead of quarterly).

3. A procurement cycle is one month long since deliveries are made on a monthly schedule.

4. Net demand during lead time refers to the expected number of demands during the upcoming month that cannot be filled with repaired assets.

5. The initial inventory level is the expected demand over half a month plus a fixed time to repair and return the item (RTAT). This ensures there are sufficient assets on hand to cover any demands prior to the first induction of failed items from the holding facility and the time required to repair those NRFI carcasses shipped from the holding facility.

6. The DELQTY is computed at the beginning of each month. If the quantity changes, the new quantity is delivered the following month.

7. Cost is not a factor in determining the repair level; only the expected number of repaired items during the next cycle is needed.

## C. SIMULATION STRUCTURE AND DESIGN

The flow chart in Figure 8 illustrates the process for the four main simulation events that will occur in the *BAND* model. Two of the four main events occur at fixed times: (i) semi-monthly "Review Repair", which implements the repair policy; and (ii) a monthly "Check Control Band", which determines the monthly delivery quantity policy. The third simulation event, "Demand", inserts randomly generated demands into the time sequencing of the event list in the same manner as the *UICP* model. The sub-events, receipt from repair and the monthly delivery from the contractor, are combined into the fourth event, "Receipt of Assets". These sub-events are scheduled into the event list randomly as a result of the simulation. See Figure 8.
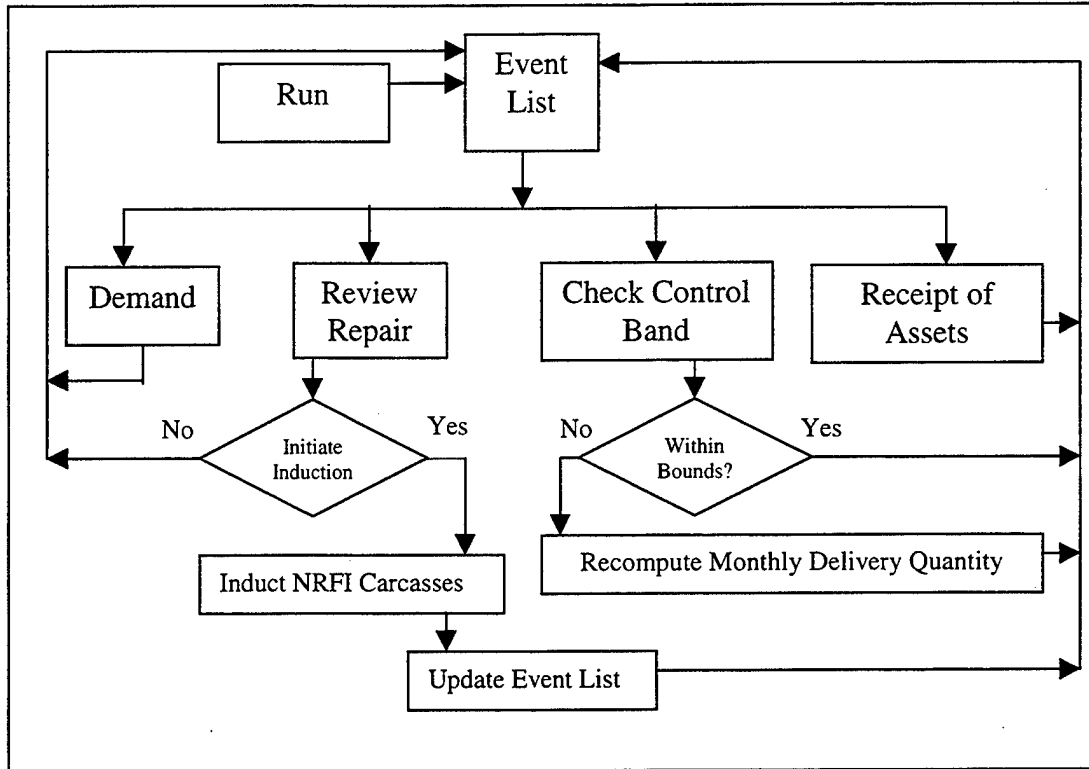
**Figure 8. Main Event List for *BAND***

As with the *UICP* model, there are numerous "sub-events" which can be randomly scheduled. The flow charts in Figures 9-11 illustrate the process for each of the main events depicted in Figure 8. The flowchart in Figure 12 shows the process when a receipt is received from the repair facility or from the contractor.

1.    **Demand**

This process (see Figure 9) is implemented as in the *UICP* simulation. Each demand is either filled if a positive inventory exists, or it is placed in backorder; accounts are updated.
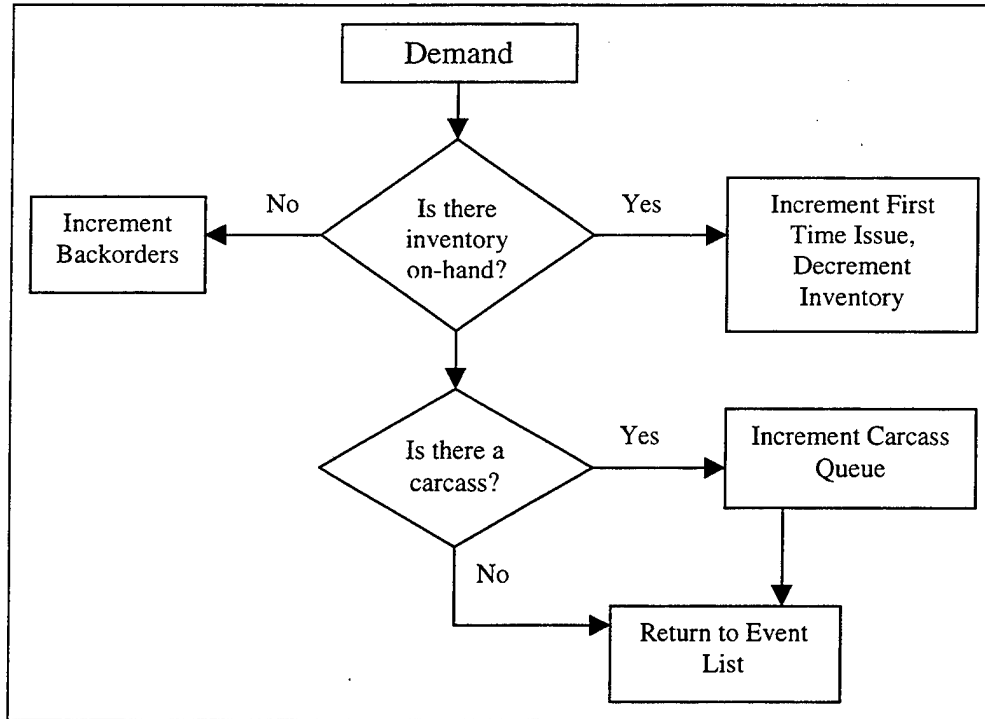
**Figure 9.  Demand Event Process**

## 2.    Review Repair

The implementation of this event is similar to that in the *UICP* simulation.  The only difference is the method used to calculate the repair level.  The Review Repair routine is scheduled twice a month.  If ASSETS (equation 11) is less than REPAIRLEVEL (equation 10), the model determines that NRFI carcasses must be shipped to the repair facility for repair.  The quantity shipped is the difference between ASSETS and REPAIRLEVEL divided by the survival rate (RSR).  As discussed in the assumptions in Chapter III, if there are insufficient NRFI carcasses on-hand to meet the required induction quantity, then all on-hand carcasses are shipped.  As in the UICP model, the quantity in the carcass queue is updated to reflect the carcasses shipped to the repair facility.  The Review Repair process is illustrated in Figure 10.
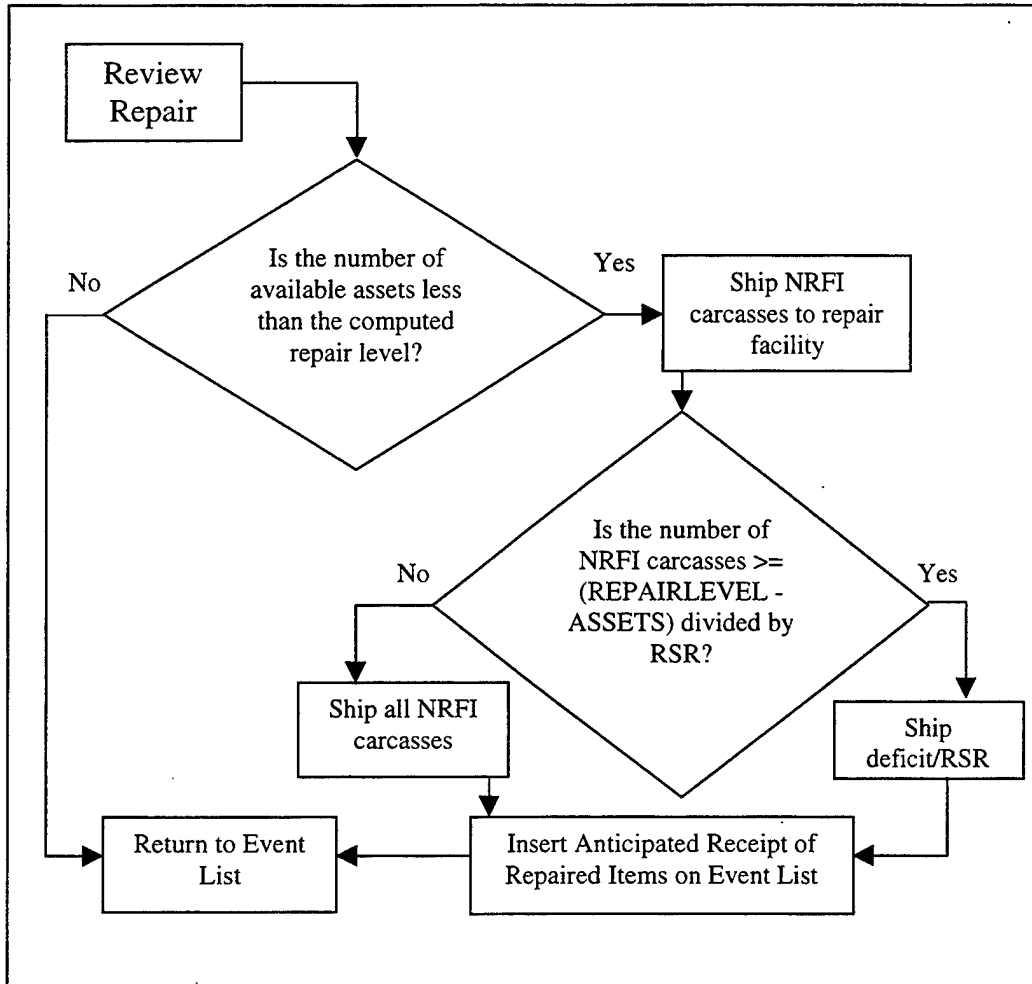
**Figure 10. Review Repair Process**

## 3. Check Control Band

This event determines if the observed monthly demand falls within the computed control band, that is, the cumulative mean number of demands plus or minus two standard deviations. Each month, the total number of demands from the most recent month are collected into a monthly bucket and used to forecast the size of the demand for the upcoming month. The current monthly demand observations are added to the cumulative observed number of demands. This value is compared to the cumulative forecasted demand. If the actual cumulative demand falls outside the control band, then the new average number of demands and associated standard deviation are computed

using the last 12-months of actual demand. Otherwise, the mean and standard deviation remain the same as the previous month.

After a new mean and standard deviation are determined, the new demand forecast for the upcoming month is computed. This forecast is used to compute control limits, REPAIRLEVEL and DELQTY. If the value of DELQTY changed from the previous month, the contractor is notified of the new quantity and is required to deliver the new quantity the following month. See Figure 11.
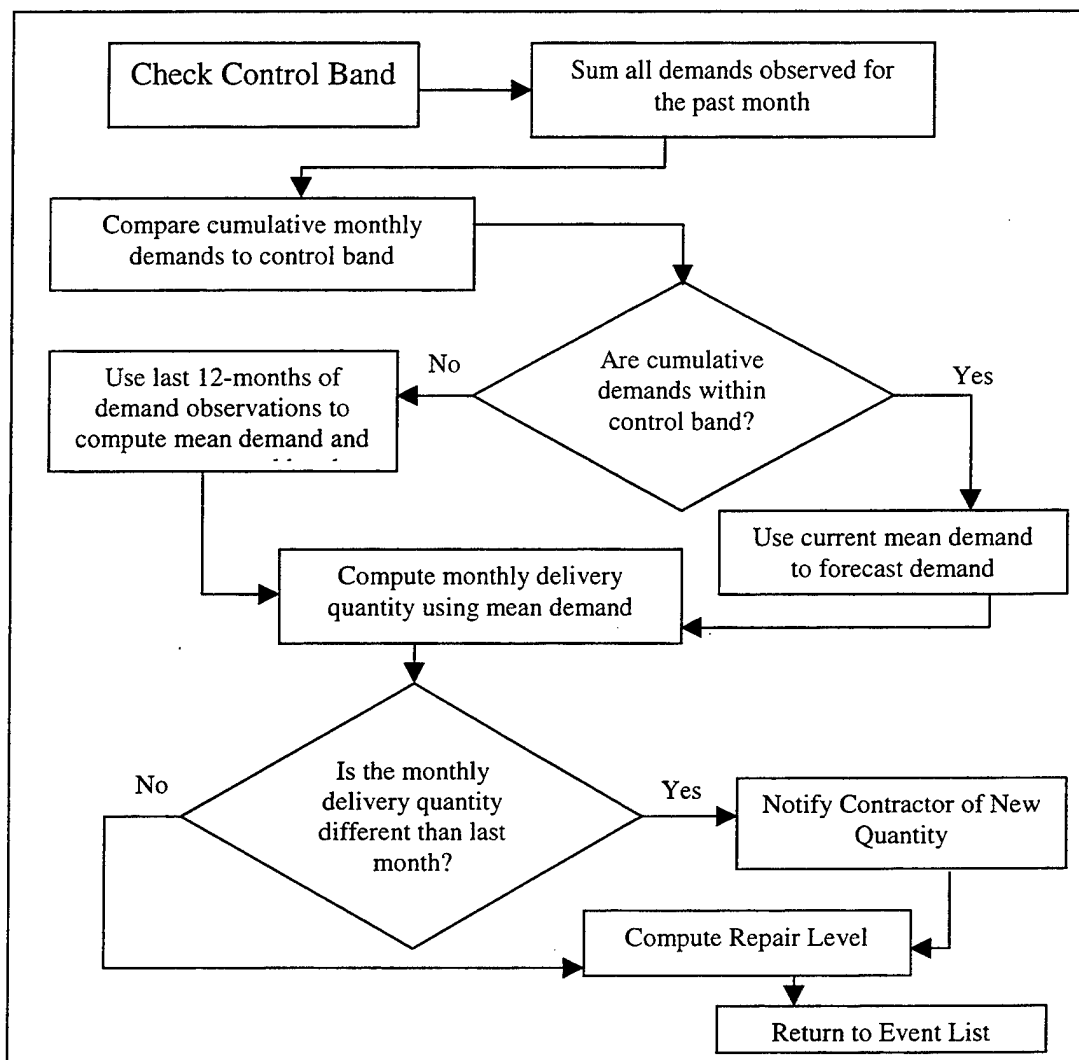


**Figure 11. Check Control Band Process**

## 4.    Receipt of Assets

Assets are received from the repair facility in the same manner as the *UICP* simulation. Assets are received from the contractor as negotiated in the initial contract. The quantity represents the expected assets lost to attrition during the previous month. The inventory level is incremented by the quantity received by either the repair facility or the contractor. If any backorders exist in the system, the oldest backorder (first in the queue) is removed and filled. At the same time, the inventory level is decreased by one. The simulation time is recorded and the difference is calculated between that time and the time the demand entered backorder. This difference represents the time that demand remained in backorder status. As with the *UICP* model, this process continues until there are no longer any assets available in inventory, or there are no more demands in backorder. See Figure 12.
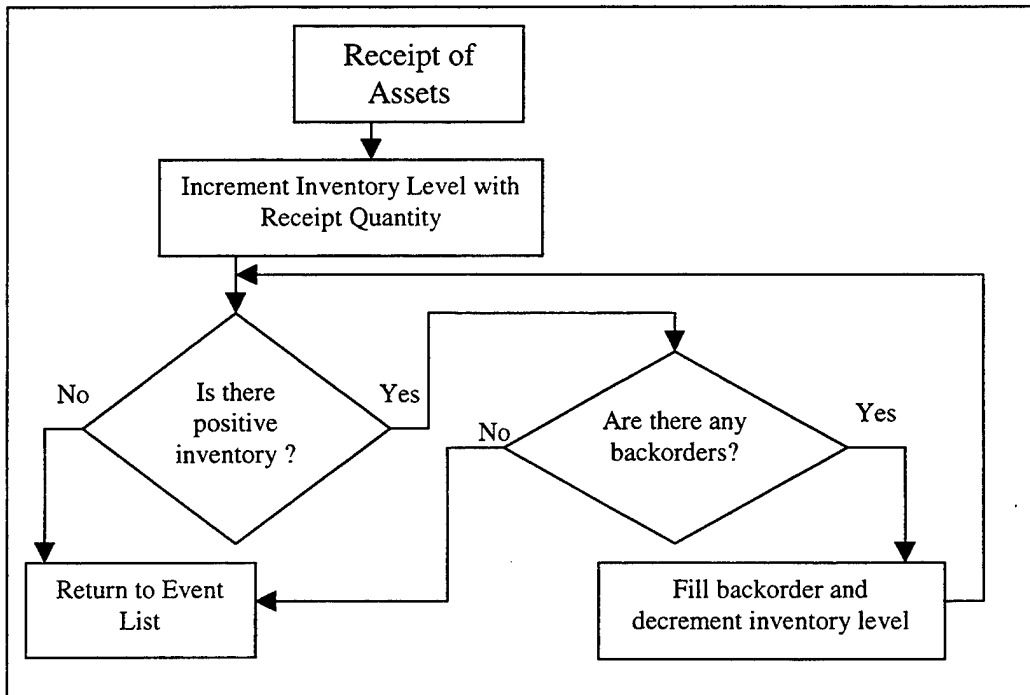


**Figure 12.  Receipt of Assets Process**

# V.    ANALYSIS

## A.    OVERVIEW

Simulation is a unique type of experiment because there is more control over inputs or factors than can usually be achieved in a physical experiment with a system (Robillard 1994). Factor selection becomes even more critical in research such as this since it is directed toward the comparative performance of two systems.

For this research, the following factors are kept constant in both simulations: Carcass Return Rate (CRR), Repair Survival Rate (RSR), and Repair Turnaround Time (RTAT). The historical values are found in Appendix F. The random number sequence is the same for both the *UICP* demand and the *BAND* demand, enabling the monthly demand stream to be exactly the same. Comparison of system performance is based on three formal measures of performance (MOE) discussed earlier: Supply Material Availability (SMA), Average Delay for Delayed Requisitions (ADDR), and Average Monthly Investment Level (AMIL).

## B.    INITIAL SIMULATION RESULTS

The simulation is required to run for 60 months in order for the inventory system to achieve steady-state operation. Initially, the system is empty, and demands are generated to establish assets in the repair and procurement pipeline. After 60 months, summary statistics are collected from the simulation run for an additional 600 months. The first comparison examines the performance of *UICP* and *BAND*. Each simulation replication consists of a total of 240 separate trials, one for each item. The data needed to compute the MOE statistics are recorded for each item. After one replication is completed, the data for each MOE are summed over all 240 items and the MOE statistics are computed. The value for each performance measure is then recorded. This process is

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repeated for thirty replications. Equations 25-27 illustrate the formulas used to compute the performance measures for each replication. The results from one replication of each system by individual identification number are found in Appendices G and H.

$$SMA = \frac{\sum_{n=1}^{240} FirstTimeIssues_n}{\sum_{n=1}^{240} Demands_n} \tag{25}$$

$$ADDR = \frac{\sum_{n=1}^{240} TotalTimeofAllBackorders_n}{\sum_{n=1}^{240} TotalNumberOfBackorders_n} \tag{26}$$

$$AMIL = \sum_{n=1}^{240} AvgMonthlyInventoryLevel_n * I * UnitPrice_n \tag{27}$$

where

| | | |
|---|---|---|
| $n$ | = | *the item being analyzed* |
| $FirstTimeIssues_n$ | = | *number of immediate satisfactions of demand requests for item n.* |
| $Demands_n$ | = | *total number of demands for item n.* |
| $TotalTimeofAllBackorders_n$ | = | *cumulative sum of waiting time in backorder for each demand of item n placed in backorder status.* |
| $TotalNumberOfBackorders_n$ | = | *total number of demands of item n placed in backorder.* |
| $AvgMonthlyInventoryLevel_n$ | = | *average quantity per month of item n in stock available to satisfy a demand.* |
| $I$ | = | *variable holding rate.* |
| $UnitPrice_n$ | = | *unit price associated with item n.* |

The MOE values for each replication of **BAND** are subtracted from the associated MOE values of **UICP**. The mean of these differences is computed to determine a point estimate. A 95% confidence interval for the point estimation is also calculated. The

point estimate and associated confidence interval for each performance measure are presented in Table 5.1.

Since a high SMA indicates better performance, the positive difference indicates *UICP* performs better for that MOE. Conversely, lower values for ADDR and AMIL are better, so the negative difference indicates the *UICP* system performs better. The columns of Table 5.1 correspond to the measures of effectiveness identified in Section A of both Chapters III and IV. The first row corresponds to the point estimate, the second row indicates the confidence interval associated with the differences of the two systems, and the last row indicates which model is preferred based on performance values for each particular measure.

The results clearly indicate that *UICP* performs better than *BAND*.

**Table 5.1 Comparison of *UICP* and *BAND* Using all 240 NIINs.**

| MOE | SMA | ADDR | AMIL ($K) |
|---|---|---|---|
| **Point Estimate** | 0.218 | -19.4534 | -82.15 |
| **CI of Differences (95% CI)** | 0.138-0.298 | -12.07--26.83 | -52.16--112.13 |
| **Preferred Model** | UICP | UICP | UICP |

## C.  SENSITIVITY ANALYSIS ON *BAND*

After comparing the overall results for the 240 items, additional analysis is performed based on an item's replacement cost. The items are partitioned into five categories which are defined by disjoint cost intervals. Table 5.2 shows the results after running ten replications for each system. The first column in the table lists the cost interval and the corresponding number of items in each interval. The remaining three columns list the three measures of effectiveness.

Although *BAND* maintains lower inventory cost for items with replacement costs less than $2500, the SMA and ADDR are still relatively inferior when compared with *UICP*.

**Table 5.2 Comparison of *UICP* and *BAND* Based Upon the Cost to Replace the Item.**

| Cost Interval($) : # of items | SMA | ADDR | AMIL ($K) |
|---|---|---|---|
| **0-700 : 46** | | | |
| Point Estimate | 0.277 | -16.17 | 1.037 |
| CI of Differences (95%) | 0.095-0.459 | -4.82- -27.53 | 0.316- 1.76 |
| Preferred System | UICP | UICP | BAND |
| **701-1400 : 51** | | | |
| Point Estimate | 0.139 | -29.89 | 2.724 |
| CI of Differences (95%) | 0.048-0.23 | -10.26- -49.52 | 0.931- 4.52 |
| Preferred System | UICP | UICP | BAND |
| **1401-2500 : 50** | | | |
| Point Estimate | 0.254 | -30.19 | 3.766 |
| CI of Differences (95%) | 0.088-0.420 | -10.43- -49.95 | 1.288-6.243 |
| Preferred System | UICP | UICP | BAND |
| **2501-5500 : 45** | | | |
| Point Estimate | 0.134 | -20.27 | -47.215 |
| CI of Differences (95%) | 0.045-0.223 | -7.00- -33.53 | -16.357- -78.072 |
| Preferred System | UICP | UICP | UICP |
| **5501-73,000 : 48** | | | |
| Point Estimate | 0.121 | -13.628 | -39.591 |
| CI of Differences (95%) | 0.039-0.202 | -4.570- -22.686 | -13.597- -65.585 |
| Preferred System | UICP | UICP | UICP |

## D.   MODIFICATION OF *BAND*

A variation of the *BAND* system, called *THIRD*, is considered, which incorporates an immediate buy concept. This concept prevents the inventory system from sustaining a large number of backorders for extended periods of time during periods of high demand. It requires that the system determine whether there are sufficient RFI and NRFI assets in the pipeline to fill existing backorders within a one-month period.

The immediate buy procedure is employed whenever the cumulative observed demand exceeds the upper control limit. The procedure compares the number of existing backorders to the total number of available assets in the supply system. The number of available assets is computed by summing the on-hand assets, assets scheduled to complete repair within an RTAT, carcasses at the holding facility awaiting shipment to the repair facility, and the monthly delivery quantity. Equation (28) refers.

$$AVAILASSETS = O/H + RFI\ DUE\ IN + (NRFI\ on\text{-}hand * RSR) + DELQTY \qquad (28)$$

where

| | | |
|---|---|---|
| *O/H* | = | *current number of RFI items in inventory* |
| *RFI Due In* | = | *number of NRFI carcasses currently being repaired by the repair facility due to be available within an RTAT.* |
| *NRFI on-hand* | = | *total number of Not Ready for Issue (NRFI) that are at the holding facility waiting to be shipped to the repair facility* |
| *RSR* | = | *probability that a NRFI carcass can be repaired by the repair facility. Referred to as Repair Survival Rate.* |
| *DELQTY* | = | *monthly delivery quantity* |

Figure 11 can be modified to reflect this policy change. If the number of backorders exceeds AVAILASSETS, the contractor is notified that a number of additional assets are required. The contractor will deliver the additional number within two months. This quantity is a "one-time buy" and is exclusive of the regularly scheduled monthly delivery. The quantity is equal to the difference between the number of backorders and AVAILASSETS. The process illustrated in Figure 12 applies once these assets are delivered.

Thirty replications of the simulation are generated for this system in the same manner as the *BAND* system. The results from one replication by individual

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identification number are presented in Appendix I. Using the same methodology as before, the *THIRD* and *UICP* are compared after each replication. The mean of the differences for each performance measure is computed to determine the point estimate for that particular measure, and the SE of the mean is computed to determine a 95 percent CI. Table 5.3 presents the global comparison of the results between *THIRD* and *UICP*. As with the analysis for *BAND*, a positive difference for SMA indicates that the *UICP* system performed better than the *THIRD* system. This also applies to a negative difference value for ADDR and AMIL. If the mean difference is negative, then the *UICP* system performed better when compared to the *THIRD* system.

**Table 5.3 Comparison of *UICP* and *THIRD* for all 240 NIINs.**

| MOE | SMA | ADDR | AMIL ($K) |
|---|---|---|---|
| Point Estimate | 0.0330 | -17.3398 | -164.39 |
| CI of Differences (95% CI) | 0.020-0.046 | -10.73--23.95 | -104.52--224.27 |
| Preferred Model | UICP | UICP | UICP |

Although this procedure performed better than *BAND* in all three measures of performance, it did not perform better than the *UICP* system.

## E.  SENSITIVITY ANALYSIS ON *THIRD*

The same strategy used in Section C is used with *THIRD*. Ten replications are run for each of the five cost categories. The results are illustrated in Figure 5.4.

**Table 5.4 Comparison of *UICP* and *THIRD* Based Upon the Cost to Replace the Item.**

| Cost Interval($) : # of items | SMA | ADDR | AMIL ($K) |
|---|---|---|---|
| **0-700 : 46** | | | |
| Point Estimate | 0.041 | -13.36 | -5.061 |
| CI of Differences (95%) | 0.013-0.069 | -4.60--22.13 | -1.748--8.373 |
| Preferred System | UICP | UICP | UICP |
| **701-1400 : 51** | | | |
| Point Estimate | -0.035 | -18.57 | -10.367 |
| CI of Differences (95%) | -0.003--0.067 | -6.27--30.88 | -3.660--17.615 |
| Preferred System | THIRD | UICP | UICP |
| **1401-2500 : 50** | | | |
| Point Estimate | 0.073 | -24.04 | -11.255 |
| CI of Differences (95%) | 0.024-0.121 | -8.23--39.85 | -3.766--18.744 |
| Preferred System | UICP | UICP | UICP |
| **2501-5500 : 45** | | | |
| Point Estimate | 0.048 | -18.78 | -63.787 |
| CI of Differences (95%) | 0.014-0.081 | -6.48--31.09 | -22.104--105.470 |
| Preferred System | UICP | UICP | UICP |
| **5501-73,000 : 48** | | | |
| Point Estimate | 0.052 | -14.19 | -71.748 |
| CI of Differences (95%) | 0.014-0.091 | -4.90--23.48 | -24.728--118.767 |
| Preferred System | UICP | UICP | UICP |

## VI. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

### A. SUMMARY

The Naval Inventory Control Point (NAVICP) is responsible for the procurement, repair, and management of over 375,000 spare parts. These include parts for ships, submarines, Naval aircraft, and all associated weapon systems and related test equipment.

NAVICP uses the Uniform Inventory Control Program (UICP) system to assist the Item Managers with decisions on when to buy, how much to buy, when to induct Not-Ready For Issue (NRFI) carcasses and how many to induct into the repair system. UICP is a fixed-order, continuous review inventory system.

Recent budget reductions have forced the NAVICP to find more cost-effective ways to manage spare parts with better customer service at a lower investment cost.

This thesis compares the current wholesale repairable inventory control process used by NAVICP to a proposed process based on the Bandwidth Management software program developed by a commercial company, (Stewart and Frazier, 1996). This is done by developing two simulation models, namely *UICP* and *BAND*. The simulations use the mean and standard deviation of the number of demands for certain repairable items identified by NAVICP, Code M051. The systems are compared using three formal measures of effectiveness (MOE's): Supply Material Availability (SMA), Average Delay for Delayed Requisitions (ADDR), and Average Monthly Investment Level (AMIL).

The *UICP* and *BAND* simulations assume the same repair process used by the current inventory control process. NRFI carcasses are periodically reviewed and inducted to the repair facility if the total number of available assets falls below the computed threshold level. The carcasses are inducted into repair in batches and returned as Ready for Issue (RFI) assets in batches. The repair level computed in *BAND* depends

only upon the expected number of carcasses that are received into the supply system and the number of those carcasses expected to be repaired and returned to the supply system as RFI assets for any given month.

The procurement process for the two systems is significantly different. The *UICP* simulation computes two decision variables. These variables represent how much to order and when to order (or reorder level). The reorder level is based upon the demand during an "average acquisition" time plus a safety level. An associated order quantity is computed based on the procurement cost, attrition demand, and related holding costs. A procurement action is initiated whenever the number of available assets falls below the reorder level. The quantity ordered is equal to the deficit below the reorder level plus the order quantity. At the end of each quarter, the demand is reforecast and the order quantity and reorder level are recomputed.

The *BAND* simulation computes a monthly delivery quantity as determined by a factor of the forecasted demand for each NIIN from the previous month. The product of the forecast demand and the wearout rate determines how many assets are required to replace those assets lost due to attrition.

## B. CONCLUSIONS

Statistics are collected from both simulations for all 240 items over a period of 600 months. The results are compared and analyzed for each measure of effectiveness. The results indicate that *BAND* does not perform as well as *UICP* in all three measures of effectiveness. Refer to Table 5.1.

Sensitivity analysis is performed on the results of all 240 items to determine whether selected groups of items can be managed more efficiently using the *BAND*

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system. The items are divided into five categories based on the replacement cost. Although the *BAND* system performs better in one of the measures for three of the categories, it does not perform better than *UCIP*. Overall, *UICP* is still considered a better inventory system for these 240 items.

An additional system *THIRD*, is developed as a variation of the *BAND* system. *THIRD* compares the existing number of backorders to all available RFI assets if the cumulative demand observations fall outside the bounds of the control band. If additional assets are required to fill existing backorders, the contractor is notified of this additional quantity and required to deliver them within two months.

The results indicate that *UICP* also performs better than *THIRD* in all three measures of performance. Refer to Table 5.3.

## C.    RECOMMENDATIONS

The *BAND* system does not appear to be a better inventory management tool for items with the same characteristics as those analyzed by the author. Therefore, it is recommended that NAVICP continue to use its existing inventory procedures. However, if the concept of regular deliveries continues to appeal to NAVICP, then further adaptations of *BAND* may be developed and compared.

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# APPENDIX A: QUARTERLY MEAN AND STANDARD
# DEVIATION OF HISTORICAL DEMAND

| NIIN | Mean | SD | NIIN | Mean | SD | NIIN | Mean | SD |
|---|---|---|---|---|---|---|---|---|
| 000805166 | 1.852 | 4.028 | 010157617 | 3.000 | 2.523 | 010501356 | 1.689 | 1.669 |
| 000805211 | 1.426 | 3.186 | 010157619 | 0.607 | 1.005 | 010501361 | 11.098 | 5.121 |
| 001024038 | 1.902 | 1.434 | 010166232 | 2.754 | 2.188 | 010501362 | 6.820 | 4.169 |
| 001053214 | 4.131 | 10.689 | 010166236 | 1.623 | 1.344 | 010501685 | 7.721 | 3.262 |
| 001110907 | 2.787 | 2.905 | 010256020 | 1.295 | 1.216 | 010507648 | 1.164 | 1.855 |
| 001115706 | 2.049 | 2.179 | 010263950 | 4.738 | 3.439 | 010515449 | 2.852 | 1.833 |
| 001122165 | 2.000 | 1.941 | 010263956 | 1.066 | 1.365 | 010521552 | 2.656 | 2.932 |
| 002185956 | 3.115 | 2.082 | 010263958 | 1.328 | 1.300 | 010543301 | 2.820 | 1.945 |
| 003172349 | 1.787 | 1.808 | 010263961 | 2.180 | 2.232 | 010603341 | 1.000 | 2.168 |
| 004766898 | 3.230 | 2.698 | 010263963 | 1.148 | 1.249 | 010603344 | 2.902 | 2.625 |
| 005557358 | 1.984 | 2.125 | 010300091 | 5.148 | 6.156 | 010603348 | 5.639 | 7.264 |
| 005557414 | 18.869 | 13.063 | 010317639 | 2.787 | 1.762 | 010624141 | 1.262 | 1.139 |
| 005557906 | 0.738 | 1.109 | 010328875 | 1.541 | 1.433 | 010628605 | 7.852 | 4.126 |
| 005759297 | 19.803 | 11.260 | 010329624 | 2.508 | 2.079 | 010629351 | 1.115 | 1.603 |
| 005966273 | 1.475 | 1.738 | 010329693 | 1.820 | 1.618 | 010629365 | 5.541 | 4.766 |
| 005966274 | 1.393 | 1.744 | 010329694 | 1.787 | 1.863 | 010640485 | 10.459 | 7.201 |
| 005966475 | 1.410 | 1.321 | 010337454 | 1.672 | 1.964 | 010658297 | 32.557 | 43.745 |
| 006011040 | 1.230 | 1.309 | 010380313 | 1.902 | 2.071 | 010670473 | 2.279 | 2.199 |
| 006011236 | 5.623 | 3.861 | 010395544 | 10.328 | 5.306 | 010684706 | 1.475 | 1.545 |
| 006011294 | 2.754 | 3.176 | 010395549 | 2.656 | 2.522 | 010685010 | 1.377 | 1.267 |
| 006011365 | 2.852 | 2.023 | 010395551 | 3.803 | 3.229 | 010691903 | 1.869 | 1.431 |
| 006011412 | 5.885 | 3.498 | 010395555 | 2.934 | 2.120 | 010694631 | 4.016 | 2.952 |
| 006011423 | 3.689 | 2.514 | 010395556 | 1.164 | 1.143 | 010694632 | 4.525 | 3.075 |
| 006011563 | 0.803 | 1.014 | 010395580 | 1.295 | 1.216 | 010761346 | 3.885 | 2.229 |
| 006026779 | 1.639 | 3.115 | 010395592 | 42.639 | 13.588 | 010875292 | 1.770 | 8.510 |
| 006026786 | 1.475 | 3.238 | 010395593 | 2.967 | 2.302 | 010881426 | 7.082 | 3.989 |
| 006026815 | 2.492 | 1.776 | 010400355 | 2.607 | 2.525 | 010898895 | 14.951 | 8.221 |
| 006026823 | 2.951 | 2.783 | 010402651 | 1.754 | 1.491 | 010914361 | 3.902 | 3.037 |
| 006026836 | 3.492 | 2.925 | 010466624 | 1.082 | 1.358 | 010931283 | 89.016 | 136.080 |
| 006137235 | 6.574 | 12.941 | 010466662 | 1.016 | 1.103 | 010931372 | 8.361 | 3.455 |
| 006137243 | 1.328 | 2.862 | 010466666 | 1.885 | 1.404 | 010931468 | 4.951 | 2.765 |
| 006137244 | 1.525 | 2.919 | 010466703 | 1.443 | 1.467 | 010942520 | 6.213 | 4.148 |
| 006137245 | 5.885 | 3.251 | 010466711 | 1.459 | 1.747 | 010942577 | 1.754 | 1.629 |
| 008707009 | 1.377 | 1.199 | 010474930 | 3.557 | 2.013 | 010942819 | 4.131 | 2.723 |
| 009460294 | 3.361 | 3.416 | 010474977 | 2.377 | 2.185 | 010992869 | 0.984 | 1.258 |
| 010036797 | 6.426 | 2.411 | 010474978 | 1.082 | 0.988 | 010992871 | 1.508 | 1.680 |
| 010066270 | 1.049 | 1.477 | 010475007 | 4.410 | 2.837 | 011000306 | 1.541 | 1.608 |
| 010090517 | 0.672 | 2.386 | 010475018 | 1.951 | 2.202 | 011026824 | 6.475 | 3.365 |
| 010157346 | 1.574 | 3.025 | 010475020 | 1.820 | 1.747 | 011029486 | 1.311 | 1.285 |
| 010157451 | 6.607 | 18.000 | 010484634 | 1.098 | 1.028 | 011110558 | 16.803 | 28.672 |
| 010157615 | 5.508 | 3.654 | 010484647 | 1.180 | 1.555 | 011167167 | 0.918 | 1.173 |

| NIIN | Mean | SD | NIIN | Mean | SD | NIIN | Mean | SD |
|------|------|-----|------|------|-----|------|------|-----|
| 011167313 | 20.082 | 51.777 | 012050364 | 1.443 | 1.133 | 013456651 | 0.164 | 0.454 |
| 011172219 | 2.918 | 2.178 | 012050427 | 1.262 | 1.237 | 013527033 | 1.148 | 2.112 |
| 011175564 | 18.869 | 55.315 | 012050456 | 1.246 | 1.374 | 013529965 | 1.344 | 7.648 |
| 011179931 | 2.934 | 2.774 | 012050795 | 0.721 | 0.933 | 013544801 | 0.705 | 1.145 |
| 011285343 | 3.885 | 2.450 | 012050797 | 1.689 | 1.597 | 013622920 | 1.377 | 1.968 |
| 011305743 | 3.705 | 2.383 | 012050799 | 1.492 | 1.649 | 013722789 | 0.820 | 1.336 |
| 011306050 | 0.951 | 1.175 | 012050871 | 2.738 | 2.523 | 013731805 | 0.656 | 2.938 |
| 011306053 | 2.033 | 1.751 | 012057064 | 6.639 | 3.573 | 013731806 | 1.508 | 3.990 |
| 011346899 | 4.279 | 2.517 | 012137310 | 2.787 | 2.042 | 013758841 | 0.820 | 2.054 |
| 011349738 | 0.197 | 0.440 | 012186385 | 2.000 | 1.683 | 013904835 | 1.721 | 4.079 |
| 011349739 | 8.951 | 4.334 | 012186392 | 4.148 | 2.522 | 013909323 | 0.902 | 2.378 |
| 011349740 | 0.393 | 0.802 | 012194678 | 2.230 | 2.334 | 013909324 | 0.426 | 1.040 |
| 011349756 | 4.295 | 2.759 | 012201789 | 0.967 | 1.224 | 013912116 | 1.033 | 2.442 |
| 011356458 | 6.738 | 3.885 | 012294506 | 1.180 | 1.190 | 013914402 | 0.443 | 0.940 |
| 011368496 | 2.590 | 1.697 | 012394886 | 3.279 | 3.629 | 013957062 | 1.016 | 2.187 |
| 011380217 | 2.115 | 4.038 | 012411959 | 3.803 | 2.414 | 013985356 | 0.033 | 0.180 |
| 011380224 | 0.803 | 1.481 | 012479676 | 1.115 | 1.550 | 014064382 | 0.016 | 0.128 |
| 011428662 | 1.607 | 1.574 | 012524331 | 2.672 | 2.650 | 014074576 | 0.066 | 0.309 |
| 011483400 | 2.230 | 1.667 | 012675048 | 1.951 | 1.755 | 014074634 | 1.639 | 3.077 |
| 011498996 | 72.066 | 111.037 | 012675068 | 2.082 | 2.319 | 014108253 | 0.197 | 0.853 |
| 011498997 | 64.033 | 93.493 | 012763958 | 0.639 | 0.797 | 014185119 | 0.033 | 0.256 |
| 011498998 | 60.426 | 95.493 | 012810084 | 1.131 | 1.688 | 014221181 | 0.164 | 0.454 |
| 011498999 | 48.820 | 74.201 | 012829008 | 0.541 | 3.128 | 014225114 | 0.426 | 1.500 |
| 011499000 | 44.492 | 60.545 | 012829115 | 1.328 | 1.886 | 014341799 | 0.180 | 0.742 |
| 011540787 | 4.033 | 2.763 | 012858138 | 3.770 | 3.185 | 014404503 | 0.180 | 0.619 |
| 011688323 | 1.197 | 1.662 | 012864787 | 3.230 | 3.607 | 014458185 | 0.033 | 0.256 |
| 011720712 | 4.607 | 3.537 | 012864789 | 0.885 | 1.644 | 014466681 | 0.033 | 0.180 |
| 011744277 | 0.934 | 1.109 | 012944162 | 4.869 | 19.348 | 150685523 | 1.852 | 1.851 |
| 011744278 | 2.197 | 1.824 | 013048188 | 1.721 | 1.984 | 150685525 | 17.049 | 21.370 |
| 011744279 | 1.066 | 1.377 | 013086683 | 1.361 | 1.798 | 150685585 | 9.197 | 7.652 |
| 011744280 | 0.787 | 1.674 | 013117486 | 34.525 | 28.422 | 151004675 | 1.443 | 2.527 |
| 011744281 | 1.738 | 1.377 | 013145858 | 1.164 | 1.614 | 151117580 | 1.295 | 1.909 |
| 011744307 | 3.754 | 6.567 | 013149207 | 0.836 | 1.083 | 997356301 | 0.230 | 1.296 |
| 011769828 | 1.541 | 2.699 | 013178331 | 1.607 | 1.706 | 997401343 | 1.770 | 2.597 |
| 011838164 | 2.246 | 1.823 | 013182610 | 5.475 | 3.594 | 998919977 | 1.852 | 7.245 |
| 011863377 | 1.492 | 1.649 | 013186355 | 1.738 | 1.897 | | | |
| 011875033 | 0.295 | 1.022 | 013311678 | 0.934 | 1.263 | | | |
| 011875041 | 2.705 | 1.969 | 013382285 | 0.475 | 0.788 | | | |
| 011875188 | 1.262 | 1.788 | 013397935 | 0.902 | 2.897 | | | |
| 011893072 | 2.918 | 1.969 | 013451504 | 1.639 | 2.569 | | | |
| 012034772 | 4.328 | 4.697 | 013456650 | 0.361 | 0.684 | | | |

# APPENDIX B.  GRAPHICAL COMPARISON OF HISTORICAL AND SIMULATED MONTHLY MEANS AND STANDARD DEVIATIONS

## Comparison of Means

$y = 0.9963x$

$R^2 = 0.9987$

45° line

Simulated Means (y-axis)

Historical Means (x-axis)

## Comparison of Standard Deviation

$y = 0.7893x$

$R^2 = 0.9631$

45° line

Simulated Standard Deviation (y-axis)

Historical Standard Deviation (x-axis)

57
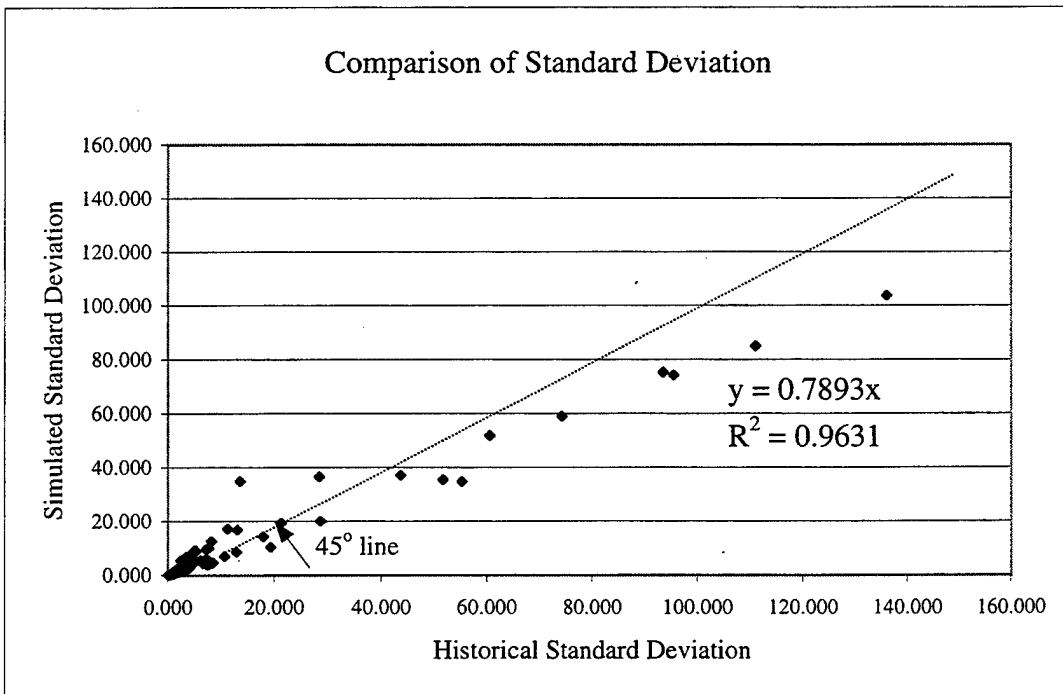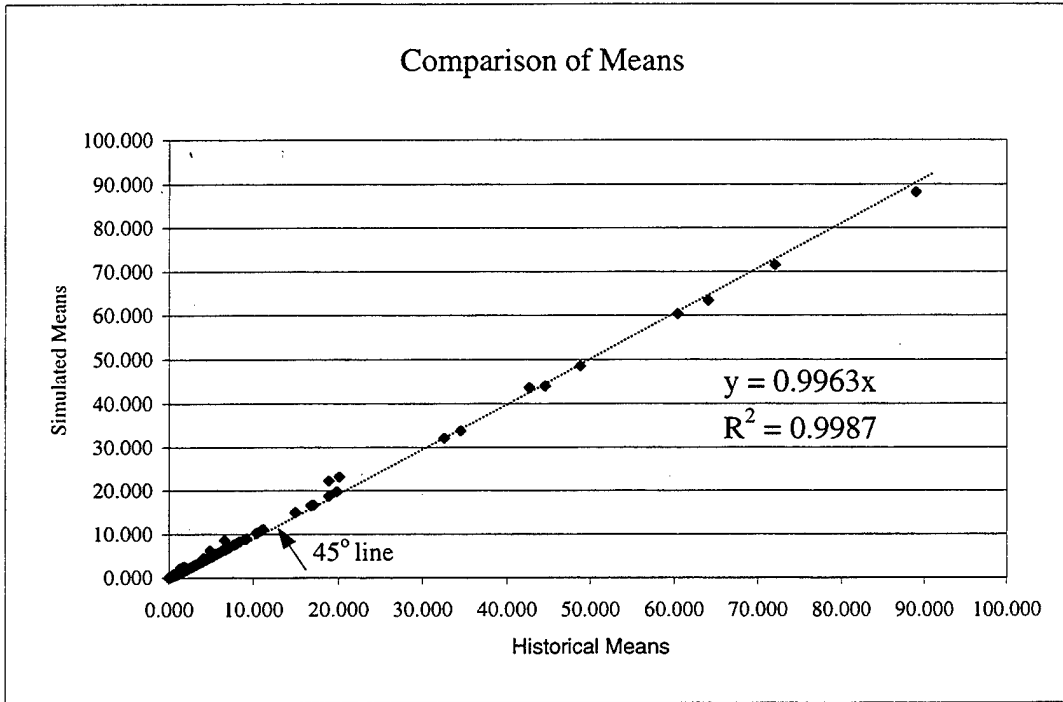
# APPENDIX C. INPUT PARAMETERS FOR *UICP* AND *BAND*

## 1. The following parameters are common to both *UICP* and *BAND*:

**National Item Identification Number (NIIN).** A unique nine character code assigned to each item of supply purchased, stocked or distributed within the Federal Government.

**Average Quarterly Demand (M).** The average quarterly demand as determined by 60 months of historical demand data.

**Standard Deviation (SD).** The associated standard deviation of the quarterly demand as determined by 60 months of historical demand data.

**Length of Simulation Run.** Length of time the simulation runs in terms of months.

**Carcass Return Rate (CRR).** The percentage of the total demands that a carcass can be expected to be turned in for repair.

**Repair Survival Rate (RSR).** The percentage of items inducted into the repair program that can be anticipated to be repaired and returned to a useable or serviceable condition.

**Repair Turnaround Time (RTAT).** Measured from the time a NRFI carcass is inducted into the repair system (changes from condition code F to M) until it is successfully repaired and returned to RFI condition (from M to A condition).

**Procurement Lead-time (PCLT).** The length of time from the generation of a procurement action until the initial receipt of material from contract. The sum of ALT and PLT.

**Cost to Repair (CTR).** The cost to the depot for repairing a NRFI carcass.

## 2. The following parameters are specific to *UICP*:

**Forecasted Demand (D).** The forecasted demand for the upcoming quarter based on 60 months of historical demand data and determined using exponential smoothing ($\alpha = 0.1$).

**Forecasted Mean Absolute Deviation of Demand (MAD).** Computed using the 60 months of historical demand data and determined using exponential smoothing ($\alpha = 0.1$).

**Navy Repair Turnaround Time MAD (rMAD).** MAD for the Repair Turnaround Time based on historical data from Navy repair depots. Used to compute the Repair Turnaround Time variance for Navy repaired items.

**Commercial Repair Turnaround Time (cMAD).** MAD for the Repair Turnaround Time based on historical data from commercial repair depots. Used to compute the Repair Turnaround Time variance for commercially repaired items.

Procurement Lead Time (pMAD). MAD for the Procurement Lead Time based on historical data from commercial companies. Used to compute the Repair Turnaround Time variance for commercially procured items.

Lead Time Demand (ITD). Demand during lead time based on historical demand data for that item.

Shortage Cost (SC). The cost associated with placing a customer request (demand) for material on backorder.

Unit Price (UP). The replacement cost of an item.

Average Requisition Quantity (RQFRQ). Average number of requisitions per order for that item based on historical data.

Safety Level Constraint ($K_1$). NAVICP-set value to ensure the safety level and reorder level does not fall below a ($1-K_1$) percentage of the Procurement Problem Variable.

National Stocking Objective (NSO). NAVICP-set value for low demand items to ensure a minimum stockage level (usually one).

Rules Code (R). NAVICP code used to identify whether the item is repaired commercially or by the Navy.

Shelf Life (SL). The number of months the item is allowed to sit on the shelf and still be considered a useable asset.

**3. The following parameter is specific to *BAND*:**

Confidence Interval for Control Band (CI). The number of standard deviations above and below the mean. Used to compute the upper and lower control bands.

# APPENDIX D. VARIABLES AND CONSTANTS

**Variables:**

$\hat{R}$:          Constrained reorder level.

$\hat{Q}$:          Constrained order quantity.

$\hat{R}_2$:          Constrained repair level.

$\sigma_{DLR}$:          Standard Deviation of demand during lead time.

AA:          Total number of potential assets available to fill demands. Applicable to the *UICP* system when determining if carcasses should be shipped to the repairing facility.

ASSETS:          Total number of potential assets available to fill demands. Applicable to the *BAND* system when determining if carcasses should be shipped to the repairing facility.

AVAILASSETS:          Total number of potential assets available to fill demands. Applicable to the *THIRD* system when determining if additional assets are required to fill backorders. This order is in addition to the monthly delivery quantity.

Backorder:          Number of demands in backorder at a specific period in time.

D:          Forecast demand for upcoming period.

DELQTY:          Monthly delivery quantity provided by the contractor. Applicable to the *BAND* system.

D-G:          Attrition demand. Those demands that did not an accompanying carcass or that could not be repaired by the repair facility.

G:          Number of demands that can be repaired and returned to wholesale stock.

IP:          Inventory position. All assets potentially available to fill demands. Used when determining if an order is needed in the *UICP* system.

MAD:          Mean Absolute Deviation of demand.

On-hand:          Number of assets on-hand in wholesale stock.

On-order:          Number of items on order that are due into wholesale stock within a procurement lead time.

PPVV: Procurement Problem Variable Variance. The variance associated with the demand during lead time.

Q: Unconstrained order quantity for the quarter.

REPAIRLEVEL: Threshold value used in *BAND* system to determine if carcasses need to be shipped to the repair facility.

RFI Due-in: The number of repaired assets due in within the next month. Associated with the *BAND* system.

RISK: Probability that a stockout will occur.

t: Standard Normal deviate associated with the probability of a stockout (RISK).

Z: Procurement Problem Variable. Net demand during lead time that cannot be filled with regenerated carcasses.

$Z_2$ Net demand during an RTAT.

## Constants:

$\lambda$: Shortage Cost per requisition.

A: Administrative cost associated with an order.

C: Unit price of an item.

$C_2$: Cost to repair one item.

CRR: Carcass Return Rate. The probability that a failed item will accompany a demand.

E: Mission Essentiality Code of the item.

F: Forecast demand/average requisition size.

H: Shelf life of the item.

I: Variable holding rate associated with holding an item in stock.

$K_0$ NAVICP-set value to ensure the minimum order quantity is at least one.

$K_1$ NAVICP-set value to ensure the safety level and reorder level do not fall below a $(1-K_1)$ percentage of the Procurement Problem Variable.

L:               Time interval beginning with the placement of an order and ending with the receipt of that order into wholesale stock. Also referred to as PCLT.

NSO:         NAVICP-set value for low demand items to ensure a minimum stockage level.

PCLT:       Time interval beginning with the placement of an order and ending with the receipt of that order into wholesale stock. Also referred to as L.

RSR:         Repair Survival Rate. The probability that a repair facility can repair an item.

RTAT:       Repair Turnaround Time. Time interval beginning with the receipt of NRFI carcasses by the repair facility to the time they are returned to the system as RFI assets.

T:               Repair Cycle Time. Equal to one RTAT plus the time between repair cycles (0.19 quarters).

W:            Wearout rate. (1-CRR*RSR)

# APPENDIX E.  DEFINITIONS OF HEADINGS FOR DATA RESULTS

NIIN:           REPAIRABLE ITEM BEING ANALYZED.

ISSUES:         NUMBER OF FIRST TIME ISSUES FOR THAT ITEM
                DURING THE 601 MONTHS.

DMDS:           NUMBER OF TOTAL DEMANDS FOR THAT ITEM DURING
                THE 601 MONTHS.

B/O'S:          TOTAL NUMBER OF BACKORDERS FOR THAT ITEM
                DURING THE 601 MONTHS

TIME IN B/O:
                CUMULATIVE TIME THAT EACH DEMAND REMAINED IN
                BACKORDER FOR THE 601 MONTHS.

AVG TIME:   TIME IN B/O DIVIDED BY B/O'S.

AVG INV LEVEL:
                AVERAGE NUMBER OF ITEMS IN STOCK PER MONTH
                FOR THE 601 MONTHS.

U/P REPL:   COST TO NAVICP TO REPLACE ITEM FROM
                COMMERCIAL SOURCE.

HOLD RT.    HOLDING RATE AS DISCUSSED IN THESIS IN TERMS OF
                MONTHLY COST.

HOLD CST:   COST TO HOLD INVENTORY PER MONTH.  (AVG INV
                LEVEL * U/P REPL * HOLD RT).

# APPENDIX F.  ASSOCIATED VALUES FOR FACTORS KEPT
## CONSTANT IN SIMULATION

| NIIN | CRR | RSR | RTAT | NIIN | CRR | RSR | RTAT | NIIN | CRR | RSR | RTAT |
|------|-----|-----|------|------|-----|-----|------|------|-----|-----|------|
| | qtrs | qtrs | qtrs | | qtrs | qtrs | qtrs | | qtrs | qtrs | qtrs |
| 000805166 | 1.00 | 0.85 | 2.62 | 010157619 | 1.00 | 1.00 | 0.43 | 010501362 | 0.97 | 0.93 | 2.77 |
| 000805211 | 1.00 | 0.85 | 2.62 | 010166232 | 1.00 | 0.95 | 0.68 | 010501685 | 0.97 | 0.88 | 0.73 |
| 001024038 | 0.98 | 1.00 | 1.35 | 010166236 | 1.00 | 1.00 | 0.65 | 010507648 | 1.00 | 1.00 | 0.35 |
| 001053214 | 1.00 | 1.00 | 0.87 | 010256020 | 0.97 | 1.00 | 0.35 | 010515449 | 0.97 | 1.00 | 1.84 |
| 001110907 | 1.00 | 1.00 | 0.49 | 010263950 | 1.00 | 0.87 | 0.5 | 010521552 | 1.00 | 0.76 | 2.75 |
| 001115706 | 1.00 | 0.76 | 1.54 | 010263956 | 1.00 | 0.88 | 0.7 | 010543301 | 0.80 | 1.00 | 0.99 |
| 001122165 | 1.00 | 0.45 | 1 | 010263958 | 0.97 | 1.00 | 0.89 | 010603341 | 0.93 | 1.00 | 0.69 |
| 002185956 | 1.00 | 1.00 | 2.19 | 010263961 | 1.00 | 0.86 | 0.61 | 010603344 | 0.96 | 1.00 | 0.11 |
| 003172349 | 0.95 | 0.82 | 1.66 | 010263963 | 1.00 | 0.86 | 0.48 | 010603348 | 1.00 | 0.95 | 0.24 |
| 004766898 | 1.00 | 0.80 | 2.89 | 010300091 | 0.97 | 0.98 | 1.65 | 010624141 | 0.99 | 0.91 | 1.2 |
| 005557358 | 0.98 | 1.00 | 0.3 | 010317639 | 1.00 | 1.00 | 1.17 | 010628605 | 1.00 | 0.88 | 0.64 |
| 005557414 | 1.00 | 0.76 | 1 | 010328875 | 1.00 | 0.85 | 1.4 | 010629351 | 0.77 | 0.82 | 2.94 |
| 005557906 | 1.00 | 0.82 | 0.93 | 010329624 | 1.00 | 1.00 | 0.37 | 010629365 | 1.00 | 0.97 | 0.31 |
| 005759297 | 0.84 | 0.95 | 1.5 | 010329693 | 1.00 | 0.85 | 0.42 | 010640485 | 0.98 | 1.00 | 1.61 |
| 005966273 | 0.95 | 0.55 | 0.46 | 010329694 | 1.00 | 1.00 | 1.02 | 010658297 | 1.00 | 0.60 | 2.07 |
| 005966274 | 1.00 | 0.55 | 0.57 | 010337454 | 0.91 | 0.90 | 0.96 | 010670473 | 0.98 | 0.81 | 0.65 |
| 005966475 | 1.00 | 0.85 | 0.86 | 010380313 | 1.00 | 0.95 | 1.15 | 010684706 | 1.00 | 0.95 | 1.17 |
| 006011040 | 1.00 | 0.85 | 0.86 | 010395544 | 0.98 | 0.99 | 0.23 | 010685010 | 1.00 | 1.00 | 2.71 |
| 006011236 | 0.99 | 0.90 | 0.52 | 010395549 | 1.00 | 1.00 | 1.13 | 010691903 | 0.97 | 0.95 | 0.99 |
| 006011294 | 1.00 | 0.72 | 0.29 | 010395551 | 1.00 | 0.98 | 1.07 | 010694631 | 0.99 | 1.00 | 0.27 |
| 006011365 | 0.95 | 0.85 | 1.47 | 010395555 | 1.00 | 0.82 | 0.85 | 010694632 | 0.99 | 1.00 | 0.35 |
| 006011412 | 1.00 | 0.30 | 0.37 | 010395556 | 0.98 | 0.85 | 0.85 | 010761346 | 1.00 | 0.96 | 0.83 |
| 006011423 | 0.94 | 0.48 | 0.2 | 010395580 | 1.00 | 1.00 | 0.31 | 010875292 | 1.00 | 0.95 | 2.23 |
| 006011563 | 1.00 | 0.93 | 1.15 | 010395592 | 1.00 | 1.00 | 0.22 | 010881426 | 1.00 | 0.98 | 0.86 |
| 006026779 | 0.96 | 0.80 | 0.5 | 010395593 | 1.00 | 0.92 | 0.85 | 010898895 | 0.99 | 0.85 | 2.22 |
| 006026786 | 0.97 | 0.89 | 0.56 | 010400355 | 0.98 | 1.00 | 0.66 | 010914361 | 0.99 | 1.00 | 1.69 |
| 006026815 | 0.86 | 1.00 | 0.25 | 010402651 | 0.98 | 1.00 | 0.92 | 010931283 | 1.00 | 0.85 | 1.32 |
| 006026823 | 1.00 | 0.95 | 0.39 | 010466624 | 0.97 | 0.93 | 1.75 | 010931372 | 0.99 | 1.00 | 0.36 |
| 006026836 | 1.00 | 0.95 | 0.22 | 010466662 | 0.97 | 0.90 | 0.88 | 010931468 | 0.99 | 0.89 | 1.49 |
| 006137235 | 1.00 | 0.92 | 1.04 | 010466666 | 0.98 | 1.00 | 0.43 | 010942520 | 1.00 | 1.00 | 1.04 |
| 006137243 | 1.00 | 0.87 | 1.9 | 010466703 | 1.00 | 1.00 | 0.7 | 010942577 | 1.00 | 0.92 | 1.25 |
| 006137244 | 1.00 | 0.96 | 0.75 | 010466711 | 1.00 | 1.00 | 0.93 | 010942819 | 1.00 | 0.90 | 0.77 |
| 006137245 | 1.00 | 0.95 | 1.64 | 010474930 | 0.99 | 1.00 | 0.93 | 010992869 | 0.92 | 0.61 | 1.22 |
| 008707009 | 1.00 | 1.00 | 2.14 | 010474977 | 1.00 | 1.00 | 1.05 | 010992871 | 0.98 | 1.00 | 0.84 |
| 009460294 | 1.00 | 0.76 | 0.99 | 010474978 | 1.00 | 1.00 | 2.78 | 011000306 | 1.00 | 1.00 | 2.38 |
| 010036797 | 0.98 | 0.85 | 1.79 | 010475007 | 1.00 | 0.95 | 0.27 | 011026824 | 1.00 | 0.85 | 2.18 |
| 010066270 | 1.00 | 0.85 | 0.86 | 010475018 | 1.00 | 1.00 | 1.04 | 011029486 | 1.00 | 0.92 | 0.5 |
| 010090517 | 0.96 | 0.85 | 1.7 | 010475020 | 1.00 | 0.98 | 1.35 | 011110558 | 1.00 | 1.00 | 1.81 |
| 010157346 | 0.85 | 0.72 | 0.96 | 010484634 | 1.00 | 1.00 | 0.59 | 011167167 | 1.00 | 1.00 | 0.58 |
| 010157451 | 0.99 | 0.85 | 1.7 | 010484647 | 1.00 | 1.00 | 0.67 | 011167313 | 0.99 | 0.85 | 1.7 |
| 010157615 | 0.95 | 1.00 | 0.52 | 010501356 | 0.98 | 0.64 | 0.52 | 011172219 | 0.99 | 1.00 | 1.98 |

| NIIN | CRR | RSR | RTAT | NIIN | CRR | RSR | RTAT | NIIN | CRR | RSR | RTAT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 010157617 | 0.91 | 1.00 | 0.28 | 010501361 | 1.00 | 0.96 | 0.52 | 011175564 | 0.99 | 0.85 | 1.7 |
|  | qtrs | qtrs | qtrs |  | qtrs | qtrs | qtrs |  | qtrs | qtrs | qtrs |
| 011179931 | 1.00 | 0.99 | 1.44 | 012050797 | 1.00 | 0.99 | 2.18 | 013722789 | 1.00 | 0.92 | 0.87 |
| 011285343 | 1.00 | 1.00 | 2 | 012050799 | 1.00 | 0.98 | 0.22 | 013731805 | 1.00 | 0.92 | 0.86 |
| 011305743 | 0.98 | 0.86 | 1.32 | 012050871 | 1.00 | 1.00 | 1.9 | 013731806 | 0.93 | 0.92 | 0.86 |
| 011306050 | 0.87 | 0.85 | 1.5 | 012057064 | 0.99 | 1.00 | 0.88 | 013758841 | 1.00 | 0.92 | 1.07 |
| 011306053 | 1.00 | 0.85 | 1.93 | 012137310 | 0.95 | 0.84 | 1.39 | 013904835 | 0.97 | 0.92 | 0.83 |
| 011346899 | 0.98 | 1.00 | 1.78 | 012186385 | 1.00 | 1.00 | 1.04 | 013909323 | 0.97 | 0.92 | 0.88 |
| 011349738 | 1.00 | 0.84 | 1.21 | 012186392 | 0.97 | 0.78 | 2.5 | 013909324 | 0.97 | 0.92 | 1.05 |
| 011349739 | 1.00 | 0.96 | 1.3 | 012194678 | 1.00 | 0.92 | 2.16 | 013912116 | 0.97 | 0.92 | 1.01 |
| 011349740 | 1.00 | 0.85 | 0.44 | 012201789 | 1.00 | 1.00 | 1.78 | 013914402 | 0.97 | 0.92 | 1.1 |
| 011349756 | 1.00 | 0.94 | 1.35 | 012294506 | 0.98 | 0.63 | 0.26 | 013957062 | 1.00 | 0.60 | 0.73 |
| 011356458 | 0.99 | 1.00 | 1.18 | 012394886 | 0.99 | 1.00 | 0.54 | 013985356 | 0.97 | 0.92 | 1.36 |
| 011368496 | 0.96 | 0.98 | 0.54 | 012411959 | 0.98 | 1.00 | 0.59 | 014064382 | 0.97 | 0.92 | 1.36 |
| 011380217 | 1.00 | 0.58 | 1.1 | 012479676 | 1.00 | 1.00 | 1.36 | 014074576 | 0.97 | 0.92 | 1.36 |
| 011380224 | 1.00 | 0.85 | 0.85 | 012524331 | 0.99 | 0.96 | 0.55 | 014074634 | 1.00 | 0.92 | 0.88 |
| 011428662 | 1.00 | 0.90 | 0.83 | 012675048 | 1.00 | 0.92 | 2.42 | 014108253 | 0.97 | 0.92 | 1.36 |
| 011483400 | 1.00 | 1.00 | 0.85 | 012675068 | 1.00 | 0.92 | 0.85 | 014185119 | 0.97 | 0.92 | 1.11 |
| 011498996 | 1.00 | 0.85 | 0.86 | 012763958 | 1.00 | 0.36 | 0.8 | 014221181 | 0.97 | 0.92 | 0.35 |
| 011498997 | 1.00 | 0.85 | 0.86 | 012810084 | 1.00 | 0.85 | 1.37 | 014225114 | 0.97 | 0.92 | 1.33 |
| 011498998 | 1.00 | 0.85 | 0.86 | 012829008 | 1.00 | 0.92 | 0.86 | 014341799 | 0.97 | 0.92 | 0.96 |
| 011498999 | 1.00 | 0.85 | 0.86 | 012829115 | 1.00 | 0.92 | 1.36 | 014404503 | 0.97 | 0.92 | 0.85 |
| 011499000 | 1.00 | 0.85 | 0.86 | 012858138 | 1.00 | 0.92 | 1.86 | 014458185 | 0.93 | 0.92 | 0.96 |
| 011540787 | 1.00 | 0.98 | 0.45 | 012864787 | 1.00 | 0.92 | 2.44 | 014466681 | 0.93 | 0.92 | 0.96 |
| 011688323 | 1.00 | 0.93 | 1.5 | 012864789 | 1.00 | 0.92 | 2.05 | 150685523 | 1.00 | 0.73 | 1.3 |
| 011720712 | 0.99 | 1.00 | 0.92 | 012944162 | 1.00 | 0.10 | 0.86 | 150685525 | 0.00 | 0.00 | 0 |
| 011744277 | 1.00 | 0.89 | 0.99 | 013048188 | 0.97 | 1.00 | 0.99 | 150685585 | 1.00 | 0.46 | 1.39 |
| 011744278 | 1.00 | 0.90 | 0.99 | 013086683 | 1.00 | 0.92 | 1.36 | 151004675 | 0.00 | 0.00 | 0 |
| 011744279 | 1.00 | 0.90 | 0.99 | 013117486 | 1.00 | 0.92 | 2.41 | 151117580 | 0.00 | 0.00 | 0 |
| 011744280 | 1.00 | 0.90 | 0.99 | 013145858 | 0.97 | 0.92 | 1.19 | 997356301 | 0.93 | 0.92 | 0.87 |
| 011744281 | 0.99 | 0.90 | 0.99 | 013149207 | 0.90 | 1.00 | 1.21 | 997401343 | 1.00 | 0.92 | 1.25 |
| 011744307 | 1.00 | 1.00 | 1.2 | 013178331 | 1.00 | 0.85 | 0.87 | 998919977 | 1.00 | 0.92 | 0.87 |
| 011769828 | 1.00 | 1.00 | 1.48 | 013182610 | 1.00 | 0.85 | 1.64 |  |  |  |  |
| 011838164 | 0.98 | 0.95 | 0.78 | 013186355 | 1.00 | 0.85 | 2.1 |  |  |  |  |
| 011863377 | 0.94 | 0.68 | 0.59 | 013311678 | 1.00 | 0.85 | 1.8 |  |  |  |  |
| 011875033 | 1.00 | 0.90 | 0.99 | 013382285 | 1.00 | 0.92 | 1.97 |  |  |  |  |
| 011875041 | 0.98 | 1.00 | 1.25 | 013397935 | 1.00 | 0.92 | 1.25 |  |  |  |  |
| 011875188 | 0.93 | 0.90 | 0.87 | 013451504 | 1.00 | 0.92 | 0.85 |  |  |  |  |
| 011893072 | 1.00 | 0.85 | 1.36 | 013456650 | 0.93 | 0.92 | 1.2 |  |  |  |  |
| 012034772 | 1.00 | 0.95 | 1.92 | 013456651 | 0.93 | 0.92 | 1 |  |  |  |  |
| 012050364 | 1.00 | 1.00 | 2.53 | 013527033 | 0.99 | 0.85 | 1.15 |  |  |  |  |
| 012050427 | 1.00 | 1.00 | 2.32 | 013529965 | 0.93 | 0.92 | 0.87 |  |  |  |  |
| 012050456 | 1.00 | 0.92 | 2.36 | 013544801 | 1.00 | 0.92 | 3 |  |  |  |  |
| 012050795 | 0.64 | 0.78 | 0.6 | 013622920 | 0.96 | 0.77 | 2 |  |  |  |  |

| NIIN | Issues | Dmds | SMA | B/O's | Time in B/O | Avg Time | Avg Inv Level (Per Month) | U/P Repl | Hold Rt (.21/12) 0.0175 | Hld Cst |
|---|---|---|---|---|---|---|---|---|---|---|
| 000805166 | 1021 | 1363 | 0.749 | 342 | 29168.75048 | 85.289 | 13.42843091 | 3450.00 | 60.375 | $810.74 |
| 000805211 | 879 | 1039 | 0.846 | 160 | 8507.084467 | 53.169 | 10.89886674 | 3037.86 | 53.16255 | $579.41 |
| 001024038 | 776 | 946 | 0.820 | 170 | 3594.750958 | 21.146 | 4.126969298 | 2067.81 | 36.186675 | $149.34 |
| 001053214 | 2994 | 3662 | 0.818 | 668 | 17174.84538 | 25.711 | 23.08077525 | 767.94 | 13.43895 | $310.18 |
| 001110907 | 1091 | 1562 | 0.698 | 474 | 7203.610904 | 15.197 | 4.046471105 | 1537.80 | 26.9115 | $108.90 |
| 001115706 | 1056 | 1058 | 0.998 | 2 | 24.31730655 | 12.159 | 13.6872567 | 491.54 | 8.60195 | $117.74 |
| 001122165 | 1038 | 1077 | 0.964 | 39 | 1518.319187 | 38.931 | 12.58692071 | 1015.68 | 17.7744 | $223.72 |
| 002185956 | 1410 | 1696 | 0.831 | 286 | 7565.279629 | 26.452 | 6.383205358 | 6346.00 | 111.055 | $708.89 |
| 003172349 | 852 | 893 | 0.954 | 41 | 900.3317037 | 21.959 | 8.158271426 | 1746.00 | 30.555 | $249.28 |
| 004766898 | 1555 | 1722 | 0.903 | 167 | 5877.610982 | 35.195 | 10.64836497 | 3073.77 | 53.790975 | $572.79 |
| 005557358 | 843 | 1055 | 0.799 | 212 | 2585.263309 | 12.195 | 2.555376763 | 4134.25 | 72.349375 | $184.88 |
| 005557414 | 8538 | 11429 | 0.747 | 2924 | 45724.70314 | 15.638 | 25.92949397 | 2747.76 | 48.0858 | $1,246.84 |
| 005557906 | 354 | 354 | 1.000 | 0 | 0 | 0.000 | 6.159166301 | 11650.99 | 203.892325 | $1,255.81 |
| 005759297 | 7437 | 11285 | 0.659 | 3857 | 99630.77593 | 25.831 | 27.17999141 | 1620.72 | 28.3626 | $770.90 |
| 005966273 | 701 | 733 | 0.956 | 32 | 454.5414839 | 14.204 | 5.333356826 | 2081.00 | 36.4175 | $194.23 |
| 005966274 | 698 | 728 | 0.959 | 30 | 384.7188371 | 12.824 | 5.7962434 | 2084.00 | 36.47 | $211.39 |
| 005966475 | 609 | 609 | 1.000 | 0 | 0 | 0.000 | 8.664323932 | 1260.59 | 22.060325 | $191.14 |
| 006011040 | 568 | 568 | 1.000 | 0 | 0 | 0.000 | 7.834606192 | 883.00 | 15.4525 | $121.06 |
| 006011236 | 2525 | 3138 | 0.805 | 613 | 7068.591268 | 11.531 | 6.550897443 | 1947.84 | 34.0872 | $223.30 |
| 006011294 | 1303 | 1492 | 0.873 | 189 | 2072.25352 | 10.964 | 7.159377446 | 484.92 | 8.4861 | $60.76 |
| 006011365 | 1465 | 1487 | 0.985 | 22 | 255.2083907 | 11.600 | 11.54988588 | 1519.40 | 26.5895 | $307.11 |
| 006011412 | 3398 | 3463 | 0.981 | 65 | 698.0235518 | 10.739 | 21.95412096 | 1005.96 | 17.6043 | $386.49 |
| 006011423 | 1954 | 2011 | 0.972 | 57 | 1456.286982 | 25.549 | 10.99064742 | 819.00 | 14.3325 | $157.52 |
| 006011563 | 340 | 340 | 1.000 | 0 | 0 | 0.000 | 4.848580068 | 1453.69 | 25.439575 | $123.35 |
| 006026779 | 944 | 1113 | 0.848 | 169 | 2826.879047 | 16.727 | 5.426503473 | 2076.00 | 36.33 | $197.14 |
| 006026786 | 900 | 1108 | 0.812 | 208 | 3875.24731 | 18.631 | 4.984068757 | 1559.00 | 27.2825 | $135.98 |
| 006026815 | 1152 | 1273 | 0.905 | 121 | 1061.649448 | 8.774 | 3.203677564 | 2517.70 | 44.05975 | $141.15 |
| 006026823 | 1343 | 1719 | 0.781 | 376 | 4491.126882 | 11.944 | 3.891624583 | 1257.00 | 21.9975 | $85.61 |
| 006026836 | 1589 | 1897 | 0.838 | 308 | 2580.625971 | 8.379 | 3.727992706 | 878.35 | 15.371125 | $57.30 |
| 006137235 | 4426 | 5124 | 0.864 | 679 | 21158.86696 | 31.162 | 30.67845502 | 821.23 | 14.371525 | $440.90 |
| 006137243 | 821 | 1023 | 0.803 | 205 | 10994.07323 | 53.630 | 6.832169813 | 20590.72 | 360.3376 | $2,461.89 |
| 006137244 | 698 | 991 | 0.704 | 293 | 8208.355283 | 28.015 | 3.656486434 | 6707.00 | 117.3725 | $429.17 |
| 006137245 | 2675 | 3269 | 0.818 | 594 | 11787.67958 | 19.845 | 8.786680848 | 5165.00 | 90.3875 | $794.21 |
| 008707009 | 601 | 613 | 0.980 | 12 | 230.0887653 | 19.174 | 5.372149694 | 12213.50 | 213.73625 | $1,148.22 |
| 009460294 | 1873 | 1973 | 0.949 | 100 | 1510.924698 | 15.109 | 12.93197687 | 1242.00 | 21.735 | $281.08 |
| 010036797 | 3313 | 3581 | 0.925 | 268 | 2300.9154 | 8.586 | 10.35951346 | 3647.77 | 63.835975 | $661.31 |
| 010066270 | 468 | 526 | 0.890 | 58 | 1397.505246 | 24.095 | 3.303844809 | 9597.39 | 167.954325 | $554.90 |
| 010090517 | 658 | 678 | 0.971 | 20 | 394.3589591 | 0.000 | 16.92752367 | 649.00 | 11.3575 | $192.25 |
| 010157346 | 953 | 1170 | 0.815 | 217 | 7453.707264 | 34.349 | 6.874710008 | 11450.00 | 200.375 | $1,377.52 |
| 010157451 | 5665 | 6554 | 0.864 | 889 | 36876.31826 | 41.481 | 64.89523926 | 1449.36 | 25.3638 | $1,645.99 |
| 010157615 | 2300 | 3073 | 0.748 | 773 | 9980.024693 | 12.911 | 5.730528152 | 1154.99 | 20.212325 | $115.83 |
| 010157617 | 1364 | 1653 | 0.825 | 289 | 2684.301108 | 9.288 | 3.933226422 | 1378.00 | 24.115 | $94.85 |
| 010157619 | 278 | 278 | 1.000 | 0 | 0 | 0.000 | 3.55836744 | 655.77 | 11.475975 | $40.84 |
| 010166232 | 1121 | 1443 | 0.777 | 323 | 4609.976502 | 14.272 | 4.275893072 | 780.55 | 13.659625 | $58.41 |

| NIIN | Issues | Dmds | SMA | B/O's | Time in B/O | Avg Time | Avg Inv Level | U/P Repl | Hold Rt (.21/12) | Hld Cst |
|---|---|---|---|---|---|---|---|---|---|---|
| 010166236 | 700 | 763 | 0.917 | 63 | 1128.829328 | 17.918 | 3.382120692 | 720.94 | 12.61645 | $42.67 |
| 010256020 | 584 | 621 | 0.940 | 37 | 429.8275707 | 11.617 | 3.053647016 | 886.74 | 15.51795 | $47.39 |
| 010263950 | 2005 | 2623 | 0.764 | 618 | 8494.512374 | 13.745 | 6.221517448 | 580.00 | 10.15 | $63.15 |
| 010263956 | 482 | 503 | 0.958 | 21 | 253.5498804 | 12.074 | 3.393520478 | 871.38 | 15.24915 | $51.75 |
| 010263958 | 501 | 584 | 0.858 | 83 | 1941.102846 | 23.387 | 2.570031951 | 528.16 | 9.2428 | $23.75 |
| 010263961 | 1048 | 1203 | 0.871 | 155 | 2465.14977 | 15.904 | 4.109834713 | 871.00 | 15.2425 | $62.64 |
| 010263963 | 525 | 530 | 0.991 | 5 | 67.18383055 | 13.437 | 5.185859636 | 501.00 | 8.7675 | $45.47 |
| 010300091 | 2211 | 3349 | 0.660 | 1138 | 46272.33569 | 40.661 | 10.97611069 | 876.49 | 15.338575 | $168.36 |
| 010317639 | 1247 | 1384 | 0.901 | 137 | 2359.439322 | 17.222 | 4.794872357 | 35050.00 | 613.375 | $2,941.05 |
| 010328875 | 667 | 735 | 0.907 | 68 | 1860.596541 | 27.362 | 5.089391278 | 2283.00 | 39.9525 | $203.33 |
| 010329624 | 1026 | 1251 | 0.820 | 225 | 2287.063434 | 10.165 | 2.897097996 | 539.21 | 9.436175 | $27.34 |
| 010329693 | 815 | 900 | 0.906 | 85 | 1093.760788 | 12.868 | 3.503507232 | 544.90 | 9.53575 | $33.41 |
| 010329694 | 752 | 903 | 0.833 | 151 | 3798.107386 | 25.153 | 4.194984329 | 2188.90 | 38.30575 | $160.69 |
| 010337454 | 903 | 968 | 0.933 | 65 | 1138.734968 | 17.519 | 5.035491527 | 795.83 | 13.927025 | $70.13 |
| 010380313 | 1004 | 1040 | 0.965 | 36 | 671.1355258 | 18.643 | 8.175621951 | 707.95 | 12.389125 | $101.29 |
| 010395544 | 4249 | 5955 | 0.714 | 1705 | 11522.55547 | 6.758 | 5.990921302 | 830.00 | 14.525 | $87.02 |
| 010395549 | 1134 | 1469 | 0.772 | 330 | 7825.629164 | 23.714 | 5.508365986 | 462.00 | 8.085 | $44.54 |
| 010395551 | 1554 | 2074 | 0.749 | 523 | 12977.63037 | 24.814 | 5.464943263 | 889.53 | 15.566775 | $85.07 |
| 010395555 | 1340 | 1593 | 0.841 | 253 | 3798.987391 | 15.016 | 5.411500234 | 801.00 | 14.0175 | $75.86 |
| 010395556 | 457 | 462 | 0.989 | 5 | 80.17511655 | 16.035 | 6.702721491 | 544.00 | 9.52 | $63.81 |
| 010395580 | 576 | 587 | 0.981 | 11 | 109.8980227 | 9.991 | 3.953395283 | 544.35 | 9.526125 | $37.66 |
| 010395592 | 12549 | 25640 | 0.489 | 13127 | 82363.32088 | 6.274 | 16.62416619 | 850.00 | 14.875 | $247.28 |
| 010395593 | 1333 | 1605 | 0.831 | 271 | 4317.032632 | 15.930 | 4.858987729 | 643.00 | 11.2525 | $54.68 |
| 010400355 | 1017 | 1415 | 0.719 | 398 | 7231.857911 | 18.170 | 3.882337594 | 950.07 | 16.626225 | $64.55 |
| 010402651 | 761 | 823 | 0.925 | 62 | 1150.374959 | 18.554 | 3.780988297 | 703.24 | 12.3067 | $46.53 |
| 010466624 | 485 | 509 | 0.953 | 25 | 517.6591544 | 20.706 | 5.466209945 | 6925.00 | 121.1875 | $662.44 |
| 010466662 | 399 | 438 | 0.911 | 39 | 855.8468019 | 21.945 | 3.373453066 | 4300.00 | 75.25 | $253.85 |
| 010466666 | 814 | 914 | 0.891 | 100 | 971.2760649 | 9.713 | 2.738141161 | 6714.00 | 117.495 | $321.72 |
| 010466703 | 637 | 670 | 0.951 | 33 | 889.3144049 | 26.949 | 4.351856044 | 905.37 | 15.843975 | $68.95 |
| 010466711 | 688 | 757 | 0.909 | 69 | 1994.632859 | 28.908 | 5.62697277 | 1601.54 | 28.02695 | $157.71 |
| 010474930 | 1498 | 1842 | 0.813 | 343 | 5225.001955 | 15.233 | 4.519268794 | 6492.00 | 113.61 | $513.43 |
| 010474977 | 893 | 1192 | 0.749 | 299 | 7824.149961 | 26.168 | 3.977900315 | 677.16 | 11.8503 | $47.14 |
| 010474978 | 398 | 425 | 0.936 | 27 | 1254.913006 | 46.478 | 7.819631846 | 2059.00 | 36.0325 | $281.76 |
| 010475007 | 2056 | 2475 | 0.831 | 419 | 3162.572633 | 7.548 | 3.86826254 | 617.55 | 10.807125 | $41.80 |
| 010475018 | 794 | 1098 | 0.723 | 304 | 8387.07965 | 27.589 | 3.843211469 | 1238.82 | 21.67935 | $83.32 |
| 010475020 | 770 | 871 | 0.884 | 100 | 2548.286075 | 25.483 | 4.069845382 | 758.20 | 13.2685 | $54.00 |
| 010484634 | 380 | 436 | 0.872 | 56 | 931.2134069 | 16.629 | 1.859220443 | 1564.00 | 27.37 | $50.89 |
| 010484647 | 485 | 585 | 0.829 | 100 | 1876.45625 | 18.765 | 3.214096334 | 1723.17 | 30.155475 | $96.92 |
| 010501356 | 801 | 845 | 0.948 | 44 | 448.6167006 | 10.196 | 5.226516912 | 2034.00 | 35.595 | $186.04 |
| 010501361 | 5046 | 6456 | 0.782 | 1410 | 12583.66036 | 8.925 | 8.472653536 | 2687.00 | 47.0225 | $398.41 |
| 010501362 | 3219 | 3999 | 0.805 | 780 | 23842.80876 | 30.568 | 13.92964578 | 2622.84 | 45.8997 | $639.37 |
| 010501685 | 3741 | 4299 | 0.870 | 561 | 5166.888524 | 9.210 | 7.928736872 | 2815.78 | 49.27615 | $390.70 |
| 010507648 | 628 | 636 | 0.987 | 8 | 41.7651239 | 5.221 | 5.643053948 | 1600.00 | 28 | $158.01 |
| 010515449 | 1397 | 1468 | 0.952 | 71 | 1108.134127 | 15.608 | 11.93500748 | 3100.00 | 54.25 | $647.47 |
| 010521552 | 1434 | 1597 | 0.898 | 163 | 6407.246514 | 39.308 | 13.19278775 | 1092.00 | 19.11 | $252.11 |

| NIIN | Issues | Dmds | SMA | B/O's | Time in B/O | Avg Time | Avg Inv Level | U/P Repl | Hold Rt (.21/12) | Hld Cst |
|---|---|---|---|---|---|---|---|---|---|---|
| 010543301 | 1281 | 1495 | 0.857 | 214 | 4580.75527 | 21.405 | 5.862925334 | 72982.00 | 1277.185 | $7,488.04 |
| 010603341 | 646 | 693 | 0.932 | 47 | 686.9291317 | 14.616 | 5.567171448 | 672.50 | 11.76875 | $65.52 |
| 010603344 | 1257 | 1562 | 0.805 | 305 | 1945.505417 | 6.379 | 2.267376471 | 537.30 | 9.40275 | $21.32 |
| 010603348 | 2074 | 3701 | 0.560 | 1627 | 19369.79169 | 11.905 | 5.754531351 | 474.11 | 8.296925 | $47.74 |
| 010624141 | 510 | 565 | 0.903 | 55 | 2050.86279 | 37.288 | 4.566688688 | 12228.00 | 213.99 | $977.23 |
| 010628605 | 3487 | 4436 | 0.786 | 949 | 10836.78431 | 11.419 | 7.930690199 | 392.00 | 6.86 | $54.40 |
| 010629351 | 559 | 559 | 1.000 | 0 | 0 | 0.000 | 12.37091109 | 2600.60 | 45.5105 | $563.01 |
| 010629365 | 2716 | 3303 | 0.822 | 587 | 4573.502846 | 7.791 | 7.163033633 | 539.31 | 9.437925 | $67.60 |
| 010640485 | 4692 | 5839 | 0.804 | 1147 | 23591.68614 | 20.568 | 17.82224245 | 698.58 | 12.22515 | $217.88 |
| 010658297 | 13977 | 22504 | 0.621 | 8527 | 461307.2029 | 54.100 | 101.2114005 | 611.71 | 10.704925 | $1,083.46 |
| 010670473 | 1076 | 1235 | 0.871 | 162 | 2937.367016 | 18.132 | 4.498636975 | 1326.00 | 23.205 | $104.39 |
| 010684706 | 608 | 691 | 0.880 | 83 | 1782.614512 | 21.477 | 3.037792324 | 4547.00 | 79.5725 | $241.72 |
| 010685010 | 610 | 633 | 0.964 | 23 | 430.987147 | 18.739 | 6.275209148 | 8571.66 | 150.00405 | $941.31 |
| 010691903 | 854 | 870 | 0.982 | 16 | 208.1434692 | 13.009 | 5.824563118 | 3295.00 | 57.6625 | $335.86 |
| 010694631 | 1548 | 2085 | 0.742 | 537 | 5166.257164 | 9.621 | 3.253413671 | 5464.00 | 95.62 | $311.09 |
| 010694632 | 1997 | 2515 | 0.794 | 520 | 5229.897421 | 10.057 | 4.429492183 | 4691.00 | 82.0925 | $363.63 |
| 010761346 | 1722 | 2066 | 0.833 | 344 | 4548.073207 | 13.221 | 4.438390997 | 2831.59 | 49.552825 | $219.93 |
| 010875292 | 1974 | 2413 | 0.818 | 446 | 25637.93762 | 57.484 | 28.30825961 | 578.43 | 10.122525 | $286.55 |
| 010881426 | 3003 | 3884 | 0.773 | 881 | 11672.31673 | 13.249 | 7.314987928 | 1033.90 | 18.09325 | $132.35 |
| 010898895 | 7422 | 8922 | 0.832 | 1501 | 28849.60694 | 19.220 | 23.23874578 | 635.37 | 11.118975 | $258.39 |
| 010914361 | 1378 | 2156 | 0.639 | 764 | 22512.3204 | 29.466 | 5.460586885 | 2747.76 | 48.0858 | $262.58 |
| 010931283 | 45614 | 66635 | 0.685 | 21021 | 758409.1003 | 36.079 | 264.2697517 | 134.13 | 2.347275 | $620.31 |
| 010931372 | 4011 | 4798 | 0.836 | 786 | 4941.894909 | 6.287 | 5.370571855 | 6318.00 | 110.565 | $593.80 |
| 010931468 | 2021 | 2728 | 0.741 | 707 | 16171.74198 | 22.874 | 6.868735441 | 4478.00 | 78.365 | $538.27 |
| 010942520 | 2497 | 3527 | 0.708 | 1035 | 19816.56223 | 19.146 | 7.361686922 | 1378.54 | 24.12445 | $177.60 |
| 010942577 | 794 | 847 | 0.937 | 53 | 1193.861746 | 22.526 | 4.81372881 | 1285.39 | 22.494325 | $108.28 |
| 010942819 | 1817 | 2271 | 0.800 | 454 | 7016.604455 | 15.455 | 4.878081754 | 814.90 | 14.26075 | $69.57 |
| 010992869 | 445 | 465 | 0.957 | 20 | 544.8923534 | 27.245 | 6.016018777 | 677.00 | 11.8475 | $71.27 |
| 010992871 | 746 | 765 | 0.975 | 19 | 194.3070385 | 10.227 | 6.523681232 | 359.54 | 6.29195 | $41.05 |
| 011000306 | 732 | 759 | 0.964 | 27 | 586.405795 | 21.719 | 7.863616601 | 22254.20 | 389.4485 | $3,062.47 |
| 011026824 | 2729 | 3529 | 0.773 | 802 | 18402.66394 | 22.946 | 10.70146864 | 2094.25 | 36.649375 | $392.20 |
| 011029486 | 592 | 594 | 0.997 | 2 | 8.88082121 | 4.440 | 4.332396122 | 1365.55 | 23.897125 | $103.53 |
| 011110558 | 6250 | 12906 | 0.484 | 6656 | 355200.3716 | 53.365 | 38.98876989 | 709.48 | 12.4159 | $484.08 |
| 011167167 | 380 | 380 | 1.000 | 0 | 0 | 0.000 | 6.475149213 | 1411.29 | 24.697575 | $159.92 |
| 011167313 | 15874 | 19065 | 0.833 | 3220 | 148508.6713 | 46.121 | 155.8461173 | 1354.32 | 23.7006 | $3,693.65 |
| 011172219 | 1476 | 1589 | 0.929 | 109 | 4773.719531 | 43.796 | 10.93897116 | 2120.89 | 37.115575 | $406.01 |
| 011175564 | 16951 | 20875 | 0.812 | 3918 | 189550.1957 | 48.379 | 164.6660444 | 2054.16 | 35.9478 | $5,919.38 |
| 011179931 | 1214 | 1525 | 0.796 | 311 | 10808.72457 | 34.755 | 6.608088306 | 4079.73 | 71.395275 | $471.79 |
| 011285343 | 1860 | 2164 | 0.860 | 304 | 6709.219104 | 22.070 | 7.627227137 | 3181.00 | 55.6675 | $424.59 |
| 011305743 | 1739 | 2055 | 0.846 | 316 | 7188.045759 | 22.747 | 7.008269475 | 4602.00 | 80.535 | $564.41 |
| 011306050 | 426 | 429 | 0.993 | 3 | 18.34855973 | 6.116 | 7.250144155 | 1538.50 | 26.92375 | $195.20 |
| 011306053 | 989 | 1028 | 0.962 | 39 | 1099.962667 | 28.204 | 9.367784237 | 1492.12 | 26.1121 | $244.61 |
| 011346899 | 1846 | 2251 | 0.820 | 405 | 8843.600132 | 21.836 | 7.737569529 | 1424.88 | 24.9354 | $192.94 |
| 011349738 | 117 | 117 | 1.000 | 0 | 0 | 0.000 | 2.816768001 | 3765.00 | 65.8875 | $185.59 |
| 011349739 | 4165 | 5142 | 0.810 | 977 | 16009.32734 | 16.386 | 10.40901575 | 4525.00 | 79.1875 | $824.26 |

| NIIN | Issues | Dmds | SMA | B/O's | Time in B/O | Avg Time | Avg Inv Level | U/P Repl | Hold Rt (.21/12) | Hld Cst |
|---|---|---|---|---|---|---|---|---|---|---|
| 011349740 | 151 | 151 | 1.000 | 0 | 0 | 0.000 | 3.148010885 | 5856.00 | 102.48 | $322.61 |
| 011349756 | 1796 | 2311 | 0.777 | 515 | 9340.251044 | 18.136 | 5.684170742 | 5882.00 | 102.935 | $585.10 |
| 011356458 | 2873 | 3656 | 0.786 | 783 | 13098.88188 | 16.729 | 8.537296858 | 4184.00 | 73.22 | $625.10 |
| 011368496 | 1053 | 1359 | 0.775 | 306 | 3958.401381 | 12.936 | 2.711704802 | 1272.00 | 22.26 | $60.36 |
| 011380217 | 1362 | 1550 | 0.879 | 188 | 7563.954954 | 40.234 | 12.86482557 | 2494.00 | 43.645 | $561.49 |
| 011380224 | 427 | 440 | 0.970 | 13 | 280.7667182 | 0.000 | 4.79701782 | 570.98 | 9.99215 | $47.93 |
| 011428662 | 724 | 768 | 0.943 | 44 | 660.7922291 | 15.018 | 4.613593409 | 6281.25 | 109.921875 | $507.13 |
| 011483400 | 1058 | 1067 | 0.992 | 9 | 93.46688379 | 10.385 | 8.950243778 | 1361.31 | 23.822925 | $213.22 |
| 011498996 | 32941 | 52040 | 0.633 | 19023 | 524524.2332 | 27.573 | 161.8702554 | 134.13 | 2.347275 | $379.95 |
| 011498997 | 33143 | 44314 | 0.748 | 11124 | 265110.0288 | 23.832 | 153.2690227 | 135.06 | 2.36355 | $362.26 |
| 011498998 | 37117 | 45341 | 0.819 | 8352 | 224924.1801 | 26.931 | 212.647012 | 111.36 | 1.9488 | $414.41 |
| 011498999 | 23221 | 38450 | 0.604 | 15235 | 421782.0657 | 27.685 | 104.2791887 | 154.95 | 2.711625 | $282.77 |
| 011499000 | 29299 | 32644 | 0.898 | 3405 | 52953.39229 | 15.552 | 164.8319889 | 206.78 | 3.61865 | $596.47 |
| 011540787 | 1747 | 2155 | 0.811 | 408 | 4366.724841 | 10.703 | 4.265212149 | 652.59 | 11.420325 | $48.71 |
| 011688323 | 577 | 673 | 0.857 | 97 | 3105.653449 | 32.017 | 3.980962017 | 12901.90 | 225.78325 | $898.83 |
| 011720712 | 1811 | 2648 | 0.684 | 837 | 16325.99931 | 19.505 | 5.868258884 | 1176.45 | 20.587875 | $120.81 |
| 011744277 | 408 | 411 | 0.993 | 3 | 37.70450068 | 12.568 | 6.984947039 | 2160.00 | 37.8 | $264.03 |
| 011744278 | 1049 | 1126 | 0.932 | 77 | 1154.246386 | 14.990 | 7.891123476 | 1531.00 | 26.7925 | $211.42 |
| 011744279 | 520 | 520 | 1.000 | 0 | 0 | 0.000 | 6.279009003 | 1625.00 | 28.4375 | $178.56 |
| 011744280 | 516 | 529 | 0.975 | 13 | 325.357457 | 0.000 | 8.203086788 | 1950.00 | 34.125 | $279.93 |
| 011744281 | 783 | 799 | 0.980 | 16 | 241.4659662 | 15.092 | 6.850921275 | 1970.00 | 34.475 | $236.19 |
| 011744307 | 1709 | 2544 | 0.672 | 835 | 30095.85684 | 36.043 | 9.207672118 | 3250.00 | 56.875 | $523.69 |
| 011769828 | 949 | 1038 | 0.914 | 89 | 2231.230511 | 25.070 | 7.901764318 | 893.80 | 15.6415 | $123.60 |
| 011838164 | 1088 | 1144 | 0.951 | 56 | 752.563675 | 13.439 | 6.938658557 | 720.94 | 12.61645 | $87.54 |
| 011863377 | 716 | 751 | 0.953 | 35 | 328.9849424 | 9.400 | 5.396655465 | 5020.49 | 87.858575 | $474.14 |
| 011875033 | 153 | 153 | 1.000 | 0 | 0 | 0.000 | 4.95593596 | 1449.18 | 25.36065 | $125.69 |
| 011875041 | 1110 | 1412 | 0.786 | 302 | 7645.842658 | 25.317 | 4.5024714 | 32920.00 | 576.1 | $2,593.87 |
| 011875188 | 708 | 737 | 0.961 | 29 | 309.8694504 | 10.685 | 5.446075831 | 2177.00 | 38.0975 | $207.48 |
| 011893072 | 1301 | 1533 | 0.849 | 232 | 4536.727315 | 19.555 | 5.300438632 | 4698.03 | 82.215525 | $435.78 |
| 012034772 | 2115 | 2676 | 0.790 | 565 | 16911.68322 | 29.932 | 11.26734566 | 1674.95 | 29.311625 | $330.26 |
| 012050364 | 516 | 633 | 0.815 | 117 | 4297.502396 | 0.000 | 3.987031526 | 10871.24 | 190.2467 | $758.52 |
| 012050427 | 538 | 604 | 0.891 | 66 | 3647.607421 | 55.267 | 5.870157324 | 9889.02 | 173.05785 | $1,015.88 |
| 012050456 | 504 | 642 | 0.785 | 138 | 4858.929344 | 35.210 | 4.551689736 | 26105.00 | 456.8375 | $2,079.38 |
| 012050795 | 280 | 280 | 1.000 | 0 | 0 | 0.000 | 5.324242358 | 17700.00 | 309.75 | $1,649.18 |
| 012050797 | 708 | 819 | 0.864 | 111 | 4185.68772 | 37.709 | 5.883387093 | 14200.00 | 248.5 | $1,462.02 |
| 012050799 | 702 | 780 | 0.900 | 78 | 634.5203348 | 8.135 | 2.236802496 | 3371.80 | 59.0065 | $131.99 |
| 012050871 | 1173 | 1442 | 0.813 | 270 | 10146.53246 | 37.580 | 7.257630975 | 4316.00 | 75.53 | $548.17 |
| 012057064 | 3794 | 3795 | 1.000 | 1 | 0.3277928 | 0.328 | 21.67888585 | 19446.00 | 340.305 | $7,377.43 |
| 012137310 | 1301 | 1457 | 0.893 | 156 | 3729.993893 | 23.910 | 6.793114119 | 10855.00 | 189.9625 | $1,290.44 |
| 012186385 | 829 | 943 | 0.879 | 114 | 2181.316106 | 19.134 | 4.596101206 | 2587.00 | 45.2725 | $208.08 |
| 012186392 | 1842 | 2170 | 0.849 | 328 | 7843.1918 | 23.912 | 10.25265618 | 6220.00 | 108.85 | $1,116.00 |
| 012194678 | 983 | 1168 | 0.842 | 185 | 9124.579608 | 49.322 | 7.881961152 | 14247.80 | 249.3365 | $1,965.26 |
| 012201789 | 449 | 467 | 0.961 | 18 | 892.3952572 | 49.578 | 5.690919204 | 11393.67 | 199.389225 | $1,134.71 |
| 012294506 | 504 | 506 | 0.996 | 2 | 12.85715991 | 6.429 | 4.763969044 | 1872.00 | 32.76 | $156.07 |
| 012394886 | 1334 | 1881 | 0.709 | 547 | 9239.397443 | 16.891 | 4.557981171 | 25650.00 | 448.875 | $2,045.96 |

| NIIN | Issues | Dmds | SMA | B/O's | Time in B/O | Avg Time | Avg Inv Level | U/P Repl | Hold Rt (.21/12) | Hld Cst |
|---|---|---|---|---|---|---|---|---|---|---|
| 012411959 | 1543 | 1987 | 0.777 | 444 | 5499.225929 | 12.386 | 3.933338618 | 12124.88 | 212.1854 | $834.60 |
| 012479676 | 506 | 569 | 0.889 | 63 | 1794.043071 | 28.477 | 5.052841286 | 2775.00 | 48.5625 | $245.38 |
| 012524331 | 1179 | 1372 | 0.859 | 192 | 3010.384063 | 15.679 | 4.84033097 | 1760.00 | 30.8 | $149.08 |
| 012675048 | 940 | 1083 | 0.868 | 143 | 4569.802283 | 31.957 | 7.679491483 | 1500.00 | 26.25 | $201.59 |
| 012675068 | 1117 | 1170 | 0.955 | 53 | 784.6393404 | 14.805 | 7.09944597 | 1099.11 | 19.234425 | $136.55 |
| 012763958 | 208 | 208 | 1.000 | 0 | 0 | 0.000 | 11.04591656 | 4865.00 | 85.1375 | $940.42 |
| 012810084 | 623 | 637 | 0.978 | 14 | 229.0527657 | 16.361 | 7.125615316 | 2350.00 | 41.125 | $293.04 |
| 012829008 | 805 | 814 | 0.989 | 9 | 87.6869594 | 9.743 | 12.02408075 | 788.67 | 13.801725 | $165.95 |
| 012829115 | 714 | 716 | 0.997 | 2 | 25.89719485 | 12.949 | 9.745382326 | 676.20 | 11.8335 | $115.32 |
| 012858138 | 1668 | 2209 | 0.755 | 541 | 17620.77719 | 32.571 | 8.93043538 | 15400.00 | 269.5 | $2,406.75 |
| 012864787 | 1485 | 1926 | 0.771 | 445 | 15208.0961 | 34.175 | 9.553920451 | 5040.00 | 88.2 | $842.66 |
| 012864789 | 522 | 547 | 0.954 | 25 | 1440.481235 | 57.619 | 7.092133902 | 11500.00 | 201.25 | $1,427.29 |
| 012944162 | 5646 | 6037 | 0.935 | 391 | 13641.03539 | 34.888 | 78.16582966 | 1406.97 | 24.621975 | $1,924.60 |
| 013048188 | 871 | 986 | 0.883 | 115 | 1904.643436 | 16.562 | 4.844954252 | 6367.17 | 111.425475 | $539.85 |
| 013086683 | 686 | 812 | 0.845 | 126 | 4789.38142 | 38.011 | 4.474320672 | 5181.95 | 90.684125 | $405.75 |
| 013117486 | 14455 | 21682 | 0.667 | 7227 | 216313.6044 | 29.931 | 53.93168004 | 893.15 | 15.630125 | $842.96 |
| 013145858 | 508 | 562 | 0.904 | 54 | 2056.209053 | 38.078 | 4.293164113 | 690.56 | 12.0848 | $51.88 |
| 013149207 | 297 | 340 | 0.874 | 39 | 1425.007273 | 36.539 | 3.441768359 | 2701.19 | 47.270825 | $162.70 |
| 013178331 | 697 | 795 | 0.877 | 98 | 2647.936034 | 27.020 | 4.558954265 | 7116.00 | 124.53 | $567.73 |
| 013182610 | 2058 | 3025 | 0.680 | 967 | 28379.11924 | 29.348 | 7.566861079 | 12150.00 | 212.625 | $1,608.90 |
| 013186355 | 782 | 899 | 0.870 | 117 | 3409.934244 | 29.145 | 5.231164615 | 4140.00 | 72.45 | $379.00 |
| 013311678 | 404 | 467 | 0.865 | 63 | 2195.271362 | 34.846 | 3.433425102 | 7226.00 | 126.455 | $434.17 |
| 013382285 | 169 | 170 | 0.994 | 1 | 3.485044547 | 3.485 | 5.210215022 | 30000.00 | 525 | $2,735.36 |
| 013397935 | 782 | 782 | 1.000 | 0 | 0 | 0.000 | 12.51620294 | 1396.14 | 24.43245 | $305.80 |
| 013451504 | 826 | 1031 | 0.801 | 205 | 5386.652094 | 26.276 | 4.79151266 | 1764.00 | 30.87 | $147.91 |
| 013456650 | 119 | 119 | 1.000 | 0 | 0 | 0.000 | 3.977616967 | 850.00 | 14.875 | $59.17 |
| 013456651 | 105 | 105 | 1.000 | 0 | 0 | 0.000 | 1.883022635 | 1319.00 | 23.0825 | $43.46 |
| 013527033 | 551 | 704 | 0.783 | 153 | 4588.430351 | 29.990 | 3.613147409 | 26075.00 | 456.3125 | $1,648.72 |
| 013529965 | 1855 | 1990 | 0.932 | 135 | 2929.002748 | 21.696 | 20.0588973 | 975.00 | 17.0625 | $342.25 |
| 013544801 | 310 | 325 | 0.954 | 15 | 1434.572855 | 95.638 | 7.41590149 | 3150.00 | 55.125 | $408.80 |
| 013622920 | 669 | 758 | 0.883 | 91 | 2984.090631 | 32.792 | 6.73848155 | 5731.41 | 100.299675 | $675.87 |
| 013722789 | 414 | 450 | 0.920 | 36 | 623.7775051 | 17.327 | 3.647328503 | 675.00 | 11.8125 | $43.08 |
| 013731805 | 787 | 809 | 0.973 | 22 | 585.8599509 | 26.630 | 11.93455987 | 2382.72 | 41.6976 | $497.64 |
| 013731806 | 1207 | 1339 | 0.901 | 132 | 2721.075677 | 20.614 | 9.766890681 | 1550.00 | 27.125 | $264.93 |
| 013758841 | 632 | 655 | 0.965 | 23 | 668.1350731 | 29.049 | 9.102732116 | 6295.00 | 110.1625 | $1,002.78 |
| 013904835 | 975 | 1392 | 0.700 | 417 | 11041.28892 | 26.478 | 5.436410059 | 559.00 | 9.7825 | $53.18 |
| 013909323 | 653 | 723 | 0.903 | 70 | 1584.813731 | 22.640 | 5.414865704 | 595.00 | 10.4125 | $56.38 |
| 013909324 | 224 | 232 | 0.966 | 8 | 266.1785007 | 33.272 | 4.334558105 | 559.00 | 9.7825 | $42.40 |
| 013912116 | 655 | 767 | 0.854 | 112 | 2990.564225 | 26.701 | 5.064675612 | 559.00 | 9.7825 | $49.55 |
| 013914402 | 199 | 200 | 0.995 | 1 | 26.36523699 | 26.365 | 3.64786084 | 559.00 | 9.7825 | $35.69 |
| 013957062 | 750 | 768 | 0.977 | 18 | 553.0918414 | 30.727 | 8.466652289 | 960.00 | 16.8 | $142.24 |
| 013985356 | 19 | 19 | 1.000 | 0 | 0 | 0.000 | 3.207944016 | 8986.56 | 157.2648 | $504.50 |
| 014064382 | 13 | 13 | 1.000 | 0 | 0 | 0.000 | 1.211206208 | 2150.99 | 37.642325 | $45.59 |
| 014074576 | 39 | 39 | 1.000 | 0 | 0 | 0.000 | 2.872252714 | 25447.16 | 445.3253 | $1,279.09 |
| 014074634 | 815 | 1095 | 0.744 | 280 | 8511.83602 | 30.399 | 5.197940302 | 3591.00 | 62.8425 | $326.65 |

| NIIN | Issues | Dmds | SMA | B/O's | Time in B/O | Avg Time | Avg Inv Level | U/P Repl | Hold Rt (.21/12) | Hld Cst |
|---|---|---|---|---|---|---|---|---|---|---|
| 014108253 | 121 | 122 | 0.992 | 1 | 5.865651375 | 0.000 | 2.828130604 | 2350.99 | 41.142325 | $116.36 |
| 014185119 | 21 | 21 | 1.000 | 0 | 0 | 0.000 | 1.788224494 | 596.25 | 10.434375 | $18.66 |
| 014221181 | 98 | 100 | 0.980 | 2 | 18.71970825 | 0.000 | 0.984752169 | 750.00 | 13.125 | $12.92 |
| 014225114 | 293 | 331 | 0.885 | 38 | 1551.500235 | 40.829 | 3.485696551 | 1520.00 | 26.6 | $92.72 |
| 014341799 | 87 | 87 | 1.000 | 0 | 0 | 0.000 | 2.914402356 | 1493.76 | 26.1408 | $76.18 |
| 014404503 | 115 | 116 | 0.991 | 1 | 8.973353358 | 8.973 | 1.922393801 | 544.00 | 9.52 | $18.30 |
| 014458185 | 17 | 17 | 1.000 | 0 | 0 | 0.000 | 1.558801917 | 6419.00 | 112.3325 | $175.10 |
| 014466681 | 24 | 24 | 1.000 | 0 | 0 | 0.000 | 2.066217709 | 6419.00 | 112.3325 | $232.10 |
| 150685523 | 825 | 982 | 0.840 | 155 | 3779.189827 | 24.382 | 5.216689063 | 2514.90 | 44.01075 | $229.59 |
| 150685525 | 10523 | 11765 | 0.894 | 1242 | 50571.42291 | 40.718 | 126.7219499 | 149.88 | 2.6229 | $332.38 |
| 150685585 | 5016 | 5947 | 0.843 | 931 | 19979.51163 | 21.460 | 23.91924641 | 5634.00 | 98.595 | $2,358.32 |
| 151004675 | 926 | 989 | 0.936 | 63 | 2751.430673 | 43.674 | 15.09487285 | 5450.00 | 95.375 | $1,439.67 |
| 151117580 | 640 | 674 | 0.950 | 34 | 1546.706491 | 45.491 | 14.23158694 | 3960.32 | 69.3056 | $986.33 |
| 997356301 | 140 | 142 | 0.986 | 2 | 26.18329443 | 0.000 | 3.939665665 | 2419.32 | 42.3381 | $166.80 |
| 997401343 | 913 | 1084 | 0.842 | 171 | 4794.138904 | 28.036 | 6.387139523 | 2929.34 | 51.26345 | $327.43 |
| 998919977 | 2012 | 2266 | 0.888 | 254 | 4811.690879 | 18.944 | 20.28433414 | 478.05 | 8.365875 | $169.70 |

| NIIN | Issues | Dmds | SMA | B/O's | Time in B/O | Avg Time | Avg Inv Level (Per Month) | U/P Repl $ | Hold Rt (.21/12) 0.0175 | Hld Cst |
|---|---|---|---|---|---|---|---|---|---|---|
| 000805166 | 1009 | 1363 | 0.7403 | 354 | 29113.87 | 82.24 | 23.13 | 3450.00 | 60.375 | 1396.7110 |
| 000805211 | 842 | 1039 | 0.8104 | 197 | 16428.82 | 83.40 | 19.95 | 3037.86 | 53.16255 | 1060.5074 |
| 001024038 | 502 | 946 | 0.5307 | 444 | 14205.53 | 31.99 | 2.41 | 2067.81 | 36.186675 | 87.1905 |
| 001053214 | 1141 | 3662 | 0.3116 | 2526 | 113820.72 | 45.06 | 7.32 | 767.94 | 13.43895 | 98.4027 |
| 001110907 | 694 | 1562 | 0.4443 | 873 | 16257.45 | 18.62 | 3.15 | 1537.80 | 26.9115 | 84.7153 |
| 001115706 | 915 | 1058 | 0.8648 | 143 | 4651.11 | 32.53 | 17.87 | 491.54 | 8.60195 | 153.7205 |
| 001122165 | 932 | 1077 | 0.8654 | 145 | 2824.24 | 19.48 | 7.06 | 1015.68 | 17.7744 | 125.4075 |
| 002185956 | 976 | 1696 | 0.5755 | 733 | 53406.46 | 72.86 | 5.64 | 6346.00 | 111.055 | 626.7666 |
| 003172349 | 754 | 893 | 0.8443 | 139 | 5395.24 | 38.81 | 14.15 | 1746.00 | 30.555 | 432.4105 |
| 004766898 | 1309 | 1722 | 0.7602 | 413 | 33876.79 | 82.03 | 26.04 | 3073.77 | 53.790975 | 1400.9801 |
| 005557358 | 888 | 1055 | 0.8417 | 168 | 1708.69 | 10.17 | 3.25 | 4134.25 | 72.349375 | 235.0044 |
| 005557414 | 6698 | 11429 | 0.5861 | 4731 | 158654.75 | 33.54 | 27.61 | 2747.76 | 48.0858 | 1327.5394 |
| 005557906 | 341 | 354 | 0.9633 | 13 | 317.12 | 24.39 | 4.80 | 11650.99 | 203.892325 | 977.9126 |
| 005759297 | 6359 | 11285 | 0.5635 | 4924 | 242543.61 | 49.26 | 32.56 | 1620.72 | 28.3626 | 923.5495 |
| 005966273 | 642 | 733 | 0.8759 | 91 | 969.72 | 10.66 | 3.45 | 2081.00 | 36.4175 | 125.5984 |
| 005966274 | 639 | 728 | 0.8777 | 86 | 1284.69 | 14.94 | 4.43 | 2084.00 | 36.47 | 161.6317 |
| 005966475 | 556 | 609 | 0.9130 | 52 | 1044.27 | 20.08 | 5.77 | 1260.59 | 22.060325 | 127.3006 |
| 006011040 | 525 | 568 | 0.9243 | 43 | 899.26 | 20.91 | 6.13 | 883.00 | 15.4525 | 94.6654 |
| 006011236 | 2340 | 3138 | 0.7457 | 792 | 9742.15 | 12.30 | 7.15 | 1947.84 | 34.0872 | 243.6502 |
| 006011294 | 1101 | 1492 | 0.7379 | 391 | 3891.96 | 9.95 | 4.42 | 484.92 | 8.4861 | 37.5241 |
| 006011365 | 1253 | 1487 | 0.8426 | 236 | 8347.57 | 35.37 | 16.52 | 1519.40 | 26.5895 | 439.2871 |
| 006011412 | 1923 | 3463 | 0.5553 | 1540 | 19195.57 | 12.46 | 4.73 | 1005.96 | 17.6043 | 83.2232 |
| 006011423 | 1475 | 2011 | 0.7335 | 536 | 3758.37 | 7.01 | 3.67 | 819.00 | 14.3325 | 52.5713 |
| 006011563 | 320 | 340 | 0.9412 | 20 | 454.48 | 22.72 | 5.87 | 1453.69 | 25.439575 | 149.2413 |
| 006026779 | 752 | 1113 | 0.6757 | 361 | 6807.46 | 18.86 | 3.87 | 2076.00 | 36.33 | 140.7566 |
| 006026786 | 861 | 1108 | 0.7771 | 247 | 4844.68 | 19.61 | 5.72 | 1559.00 | 27.2825 | 156.0510 |
| 006026815 | 724 | 1273 | 0.5687 | 551 | 30642.20 | 55.61 | 2.73 | 2517.70 | 44.05975 | 120.2589 |
| 006026823 | 1280 | 1719 | 0.7446 | 439 | 4935.19 | 11.24 | 4.27 | 1257.00 | 21.9975 | 93.9382 |
| 006026836 | 1742 | 1897 | 0.9183 | 155 | 1028.85 | 6.64 | 5.46 | 878.35 | 15.371125 | 83.9063 |
| 006137235 | 3010 | 5124 | 0.5874 | 2081 | 84413.08 | 40.56 | 20.39 | 821.23 | 14.371525 | 292.9685 |
| 006137243 | 862 | 1023 | 0.8426 | 161 | 9321.47 | 57.90 | 14.97 | 20590.72 | 360.3376 | 5394.3611 |
| 006137244 | 795 | 991 | 0.8022 | 196 | 4922.33 | 25.11 | 7.69 | 6707.00 | 117.3725 | 902.2645 |
| 006137245 | 2254 | 3269 | 0.6895 | 1015 | 53085.99 | 52.30 | 19.12 | 5165.00 | 90.3875 | 1728.4213 |
| 008707009 | 430 | 613 | 0.7015 | 181 | 10963.69 | 60.57 | 4.31 | 12213.50 | 213.73625 | 920.7040 |
| 009460294 | 1521 | 1973 | 0.7709 | 452 | 11212.48 | 24.81 | 10.81 | 1242.00 | 21.735 | 234.9744 |
| 010036797 | 2533 | 3581 | 0.7073 | 1061 | 55042.50 | 51.88 | 25.30 | 3647.77 | 63.835975 | 1615.2041 |
| 010066270 | 484 | 526 | 0.9202 | 42 | 729.29 | 17.36 | 6.06 | 9597.39 | 167.954325 | 1018.0630 |
| 010090517 | 605 | 678 | 0.8923 | 73 | 3024.87 | 41.44 | 16.10 | 649.00 | 11.3575 | 182.8249 |
| 010157346 | 946 | 1170 | 0.8085 | 224 | 5256.57 | 23.47 | 11.68 | 11450.00 | 200.375 | 2340.7796 |
| 010157451 | 3324 | 6554 | 0.5072 | 3230 | 230615.29 | 71.40 | 22.84 | 1449.36 | 25.3638 | 579.3011 |
| 010157615 | 917 | 3073 | 0.2984 | 2160 | 58478.01 | 27.07 | 3.51 | 1154.99 | 20.212325 | 70.8755 |
| 010157617 | 1325 | 1653 | 0.8016 | 328 | 2928.62 | 8.93 | 4.23 | 1378.00 | 24.115 | 101.9750 |
| 010157619 | 131 | 278 | 0.4712 | 147 | 3337.05 | 22.70 | 0.85 | 655.77 | 11.475975 | 9.7472 |
| 010166232 | 1196 | 1443 | 0.8288 | 250 | 3642.87 | 14.57 | 6.92 | 780.55 | 13.659625 | 94.5352 |

| NIIN | Issues | Dmds | SMA | B/O's | Time in B/O | Avg Time | Avg Inv Level (Per Month) | U/P Repl $ | Hold Rt (.21/12) 0.0175 | Hld Cst |
|---|---|---|---|---|---|---|---|---|---|---|
| 010166236 | 476 | 763 | 0.6239 | 287 | 4979.62 | 17.35 | 2.38 | 720.94 | 12.61645 | 30.0249 |
| 010256020 | 393 | 621 | 0.6329 | 228 | 5948.34 | 26.09 | 1.95 | 886.74 | 15.51795 | 30.2009 |
| 010263950 | 1447 | 2623 | 0.5517 | 1176 | 16288.40 | 13.85 | 4.25 | 580.00 | 10.15 | 43.0998 |
| 010263956 | 471 | 503 | 0.9364 | 32 | 622.41 | 19.45 | 5.04 | 871.38 | 15.24915 | 76.8660 |
| 010263958 | 463 | 584 | 0.7928 | 121 | 2920.91 | 24.14 | 3.53 | 528.16 | 9.2428 | 32.5815 |
| 010263961 | 973 | 1203 | 0.8088 | 230 | 3884.57 | 16.89 | 4.45 | 871.00 | 15.2425 | 67.7659 |
| 010263963 | 484 | 530 | 0.9132 | 46 | 568.63 | 12.36 | 2.69 | 501.00 | 8.7675 | 23.5521 |
| 010300091 | 2316 | 3349 | 0.6915 | 1051 | 62640.88 | 59.60 | 25.83 | 876.49 | 15.338575 | 396.2423 |
| 010317639 | 892 | 1384 | 0.6445 | 492 | 12558.85 | 25.53 | 2.97 | 35050.00 | 613.375 | 1822.1365 |
| 010328875 | 662 | 735 | 0.9007 | 73 | 2187.75 | 29.97 | 10.77 | 2283.00 | 39.9525 | 430.3399 |
| 010329624 | 770 | 1251 | 0.6155 | 481 | 5363.31 | 11.15 | 2.56 | 539.21 | 9.436175 | 24.1782 |
| 010329693 | 740 | 900 | 0.8222 | 160 | 1787.22 | 11.17 | 3.08 | 544.90 | 9.53575 | 29.3708 |
| 010329694 | 567 | 903 | 0.6279 | 336 | 9195.49 | 27.37 | 2.47 | 2188.90 | 38.30575 | 94.5200 |
| 010337454 | 836 | 968 | 0.8636 | 132 | 2886.66 | 21.87 | 7.50 | 795.83 | 13.927025 | 104.4927 |
| 010380313 | 880 | 1040 | 0.8462 | 158 | 5729.29 | 36.26 | 10.49 | 707.95 | 12.389125 | 129.9875 |
| 010395544 | 5324 | 5955 | 0.8940 | 631 | 2913.48 | 4.62 | 8.71 | 830.00 | 14.525 | 126.5251 |
| 010395549 | 758 | 1469 | 0.5160 | 699 | 23584.49 | 33.74 | 3.69 | 462.00 | 8.085 | 29.8202 |
| 010395551 | 1636 | 2074 | 0.7888 | 438 | 16151.10 | 36.87 | 13.11 | 889.53 | 15.566775 | 204.0742 |
| 010395555 | 1351 | 1593 | 0.8481 | 242 | 4587.73 | 18.96 | 8.87 | 801.00 | 14.0175 | 124.3244 |
| 010395556 | 437 | 462 | 0.9459 | 25 | 485.66 | 19.43 | 6.20 | 544.00 | 9.52 | 58.9828 |
| 010395580 | 385 | 587 | 0.6559 | 200 | 2198.23 | 10.99 | 1.60 | 544.35 | 9.526125 | 15.2628 |
| 010395592 | 19427 | 25640 | 0.7577 | 6236 | 28553.77 | 4.58 | 18.20 | 850.00 | 14.875 | 270.7016 |
| 010395593 | 1350 | 1605 | 0.8411 | 255 | 5386.67 | 21.12 | 10.12 | 643.00 | 11.2525 | 113.9019 |
| 010400355 | 657 | 1415 | 0.4643 | 758 | 17582.79 | 23.20 | 2.80 | 950.07 | 16.626225 | 46.5676 |
| 010402651 | 644 | 823 | 0.7825 | 179 | 3466.82 | 19.37 | 3.14 | 703.24 | 12.3067 | 38.6438 |
| 010466624 | 473 | 509 | 0.9293 | 39 | 1883.30 | 48.29 | 14.22 | 6925.00 | 121.1875 | 1723.4282 |
| 010466662 | 404 | 438 | 0.9224 | 34 | 844.98 | 24.85 | 6.63 | 4300.00 | 75.25 | 499.1348 |
| 010466666 | 698 | 914 | 0.7637 | 216 | 2437.76 | 11.29 | 2.59 | 6714.00 | 117.495 | 304.1843 |
| 010466703 | 528 | 670 | 0.7881 | 142 | 2636.17 | 18.56 | 2.39 | 905.37 | 15.843975 | 37.9387 |
| 010466711 | 506 | 757 | 0.6684 | 250 | 7019.29 | 28.08 | 3.04 | 1601.54 | 28.02695 | 85.3378 |
| 010474930 | 556 | 1842 | 0.3018 | 1283 | 37970.87 | 29.60 | 2.19 | 6492.00 | 113.61 | 248.3344 |
| 010474977 | 759 | 1192 | 0.6367 | 435 | 11481.81 | 26.39 | 4.01 | 677.16 | 11.8503 | 47.5039 |
| 010474978 | 318 | 425 | 0.7482 | 107 | 10434.80 | 97.52 | 6.56 | 2059.00 | 36.0325 | 236.3816 |
| 010475007 | 2273 | 2475 | 0.9184 | 202 | 1182.70 | 5.85 | 5.36 | 617.55 | 10.807125 | 57.9376 |
| 010475018 | 527 | 1098 | 0.4800 | 571 | 16594.28 | 29.06 | 2.32 | 1238.82 | 21.67935 | 50.3792 |
| 010475020 | 734 | 871 | 0.8427 | 134 | 4732.49 | 35.32 | 8.36 | 758.20 | 13.2685 | 110.9581 |
| 010484634 | 391 | 436 | 0.8968 | 45 | 663.78 | 14.75 | 2.49 | 1564.00 | 27.37 | 68.1663 |
| 010484647 | 460 | 585 | 0.7863 | 125 | 1979.40 | 15.84 | 2.48 | 1723.17 | 30.155475 | 74.9240 |
| 010501356 | 795 | 845 | 0.9408 | 50 | 437.12 | 8.74 | 4.84 | 2034.00 | 35.595 | 172.3365 |
| 010501361 | 4332 | 6456 | 0.6710 | 2136 | 24103.13 | 11.28 | 8.88 | 2687.00 | 47.0225 | 417.6157 |
| 010501362 | 2573 | 3999 | 0.6434 | 1422 | 147058.10 | 103.42 | 28.33 | 2622.84 | 45.8997 | 1300.5676 |
| 010501685 | 3008 | 4299 | 0.6997 | 1291 | 19109.60 | 14.80 | 8.12 | 2815.78 | 49.27615 | 400.3625 |
| 010507648 | 466 | 636 | 0.7327 | 172 | 2417.96 | 14.06 | 1.74 | 1600.00 | 28 | 48.6598 |
| 010515449 | 917 | 1468 | 0.6247 | 542 | 30294.80 | 55.89 | 5.13 | 3100.00 | 54.25 | 278.2576 |

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| NIIN | Issues | Dmds | SMA | B/O's | Time in B/O | Avg Time | Avg Inv Level (Per Month) | U/P Repl $ | Hold Rt (.21/12) 0.0175 | Hld Cst |
|---|---|---|---|---|---|---|---|---|---|---|
| 010521552 | 1277 | 1597 | 0.7996 | 326 | 23466.67 | 71.98 | 28.56 | 1092.00 | 19.11 | 545.7952 |
| 010543301 | 1160 | 1495 | 0.7759 | 337 | 8045.11 | 23.87 | 7.45 | 72982.00 | 1277.185 | 9517.2226 |
| 010603341 | 545 | 693 | 0.7864 | 151 | 4450.61 | 29.47 | 4.99 | 672.50 | 11.76875 | 58.6690 |
| 010603344 | 1531 | 1562 | 0.9802 | 31 | 116.82 | 3.77 | 5.15 | 537.30 | 9.40275 | 48.4160 |
| 010603348 | 2665 | 3701 | 0.7201 | 1036 | 9552.32 | 9.22 | 8.18 | 474.11 | 8.296925 | 67.8570 |
| 010624141 | 510 | 565 | 0.9027 | 55 | 1603.16 | 29.15 | 8.79 | 12228.00 | 213.99 | 1879.9294 |
| 010628605 | 2426 | 4436 | 0.5469 | 2010 | 29088.10 | 14.47 | 5.85 | 392.00 | 6.86 | 40.1593 |
| 010629351 | 529 | 559 | 0.9463 | 30 | 1899.23 | 63.31 | 22.51 | 2600.60 | 45.5105 | 1024.2399 |
| 010629365 | 2390 | 3303 | 0.7236 | 913 | 7694.38 | 8.43 | 6.56 | 539.31 | 9.437925 | 61.9282 |
| 010640485 | 3507 | 5839 | 0.6006 | 2332 | 122628.09 | 52.58 | 21.89 | 698.58 | 12.22515 | 267.6584 |
| 010658297 | 12492 | 22504 | 0.5551 | 10021 | 593731.06 | 59.25 | 106.04 | 611.71 | 10.704925 | 1135.1284 |
| 010670473 | 912 | 1235 | 0.7385 | 326 | 5460.40 | 16.75 | 4.07 | 1326.00 | 23.205 | 94.3617 |
| 010684706 | 648 | 691 | 0.9378 | 43 | 1463.04 | 34.02 | 11.79 | 4547.00 | 79.5725 | 937.9078 |
| 010685010 | 418 | 633 | 0.6603 | 215 | 19711.42 | 91.68 | 4.67 | 8571.66 | 150.00405 | 700.6394 |
| 010691903 | 774 | 870 | 0.8897 | 96 | 2372.95 | 24.72 | 7.24 | 3295.00 | 57.6625 | 417.6395 |
| 010694631 | 1702 | 2085 | 0.8163 | 383 | 3260.84 | 8.51 | 4.55 | 5464.00 | 95.62 | 434.7018 |
| 010694632 | 1801 | 2515 | 0.7161 | 718 | 6727.56 | 9.37 | 4.46 | 4691.00 | 82.0925 | 365.8159 |
| 010761346 | 1558 | 2066 | 0.7541 | 508 | 9468.59 | 18.64 | 6.50 | 2831.59 | 49.552825 | 321.9553 |
| 010875292 | 1459 | 2413 | 0.6046 | 956 | 81690.74 | 85.45 | 18.28 | 578.43 | 10.122525 | 185.0744 |
| 010881426 | 2619 | 3884 | 0.6743 | 1265 | 37666.40 | 29.78 | 13.14 | 1033.90 | 18.09325 | 237.7480 |
| 010898895 | 5357 | 8922 | 0.6004 | 3501 | 276069.04 | 78.85 | 36.30 | 635.37 | 11.118975 | 403.6731 |
| 010914361 | 939 | 2156 | 0.4355 | 1203 | 51526.02 | 42.83 | 3.84 | 2747.76 | 48.0858 | 184.7763 |
| 010931283 | 25100 | 66635 | 0.3767 | 41535 | 2404695.48 | 57.90 | 118.66 | 134.13 | 2.347275 | 278.5212 |
| 010931372 | 3680 | 4798 | 0.7670 | 1117 | 6976.43 | 6.25 | 5.25 | 6318.00 | 110.565 | 580.4534 |
| 010931468 | 1919 | 2728 | 0.7034 | 809 | 34710.19 | 42.91 | 15.53 | 4478.00 | 78.365 | 1216.9878 |
| 010942520 | 1874 | 3527 | 0.5313 | 1667 | 52201.22 | 31.31 | 6.10 | 1378.54 | 24.12445 | 147.2383 |
| 010942577 | 779 | 847 | 0.9197 | 68 | 1374.07 | 20.21 | 10.78 | 1285.39 | 22.494325 | 242.4852 |
| 010942819 | 1732 | 2271 | 0.7627 | 539 | 9953.06 | 18.47 | 7.10 | 814.90 | 14.26075 | 101.2173 |
| 010992869 | 435 | 465 | 0.9355 | 30 | 535.98 | 17.87 | 8.10 | 677.00 | 11.8475 | 95.9674 |
| 010992871 | 634 | 765 | 0.8288 | 131 | 2945.58 | 22.49 | 5.16 | 359.54 | 6.29195 | 32.4855 |
| 011000306 | 503 | 759 | 0.6627 | 259 | 18539.94 | 71.58 | 4.20 | 22254.20 | 389.4485 | 1635.7041 |
| 011026824 | 2426 | 3529 | 0.6874 | 1117 | 79443.66 | 71.12 | 27.18 | 2094.25 | 36.649375 | 996.2092 |
| 011029486 | 524 | 594 | 0.8822 | 70 | 944.59 | 13.49 | 2.93 | 1365.55 | 23.897125 | 70.0325 |
| 011110558 | 2920 | 12906 | 0.2263 | 9998 | 789898.84 | 79.01 | 22.80 | 709.48 | 12.4159 | 283.1318 |
| 011167167 | 249 | 380 | 0.6553 | 130 | 2627.42 | 20.21 | 0.94 | 1411.29 | 24.697575 | 23.2273 |
| 011167313 | 7044 | 19065 | 0.3695 | 12120 | 866600.78 | 71.50 | 38.16 | 1354.32 | 23.7006 | 904.3060 |
| 011172219 | 904 | 1589 | 0.5689 | 685 | 47301.88 | 69.05 | 5.68 | 2120.89 | 37.115575 | 210.7700 |
| 011175564 | 8098 | 20875 | 0.3879 | 12712 | 873033.16 | 68.68 | 53.68 | 2054.16 | 35.9478 | 1929.6227 |
| 011179931 | 1010 | 1525 | 0.6623 | 515 | 24734.84 | 48.03 | 7.25 | 4079.73 | 71.395275 | 517.8867 |
| 011285343 | 1015 | 2164 | 0.4690 | 1149 | 73043.61 | 63.57 | 3.99 | 3181.00 | 55.6675 | 222.2783 |
| 011305743 | 1527 | 2055 | 0.7431 | 531 | 18621.01 | 35.07 | 12.69 | 4602.00 | 80.535 | 1022.0592 |
| 011306050 | 386 | 429 | 0.8998 | 43 | 1854.46 | 43.13 | 11.00 | 1538.50 | 26.92375 | 296.1476 |
| 011306053 | 872 | 1028 | 0.8482 | 156 | 7335.47 | 47.02 | 18.17 | 1492.12 | 26.1121 | 474.4105 |
| 011346899 | 1370 | 2251 | 0.6086 | 881 | 53892.13 | 61.17 | 8.91 | 1424.88 | 24.9354 | 222.2607 |

| NIIN | Issues | Dmds | SMA | B/O's | Time in B/O | Avg Time | Avg Inv Level (Per Month) | U/P Repl $ | Hold Rt (.21/12) 0.0175 | Hld Cst |
|---|---|---|---|---|---|---|---|---|---|---|
| 011349738 | 117 | 117 | 1.0000 | 0 | 0.00 | 0.00 | 7.14 | 3765.00 | 65.8875 | 470.1727 |
| 011349739 | 3564 | 5107 | 0.6979 | 1543 | 60745.64 | 39.37 | 24.05 | 4525.00 | 79.1875 | 1904.6800 |
| 011349740 | 155 | 155 | 1.0000 | 0 | 0.00 | #DIV/0! | 3.43 | 5856.00 | 102.48 | 351.2905 |
| 011349756 | 1783 | 2272 | 0.7848 | 475 | 18366.82 | 38.67 | 17.20 | 5882.00 | 102.935 | 1770.2353 |
| 011356458 | 2079 | 3748 | 0.5547 | 1664 | 58894.40 | 35.39 | 8.00 | 4184.00 | 73.22 | 585.5339 |
| 011368496 | 1092 | 1239 | 0.8814 | 147 | 1912.92 | 13.01 | 4.56 | 1272.00 | 22.26 | 101.5122 |
| 011380217 | 1325 | 1638 | 0.8089 | 313 | 9419.08 | 30.09 | 16.04 | 2494.00 | 43.645 | 699.9183 |
| 011380224 | 424 | 455 | 0.9319 | 31 | 688.58 | 22.21 | 5.36 | 570.98 | 9.99215 | 53.5448 |
| 011428662 | 667 | 790 | 0.8443 | 123 | 2309.41 | 18.78 | 4.83 | 6281.25 | 109.921875 | 531.0221 |
| 011483400 | 820 | 1088 | 0.7537 | 268 | 4308.26 | 16.08 | 3.16 | 1361.31 | 23.822925 | 75.2342 |
| 011498996 | 24844 | 50394 | 0.4930 | 25550 | 1023419.82 | 40.06 | 109.47 | 134.13 | 2.347275 | 256.9508 |
| 011498997 | 19332 | 45253 | 0.4272 | 25805 | 968156.60 | 37.52 | 75.12 | 135.06 | 2.36355 | 177.5550 |
| 011498998 | 18989 | 43129 | 0.4403 | 23965 | 882623.49 | 36.83 | 74.49 | 111.36 | 1.9488 | 145.1590 |
| 011498999 | 11733 | 36022 | 0.3257 | 24498 | 904265.41 | 36.91 | 47.55 | 154.95 | 2.711625 | 128.9427 |
| 011499000 | 11087 | 33534 | 0.3306 | 22514 | 829329.72 | 36.84 | 45.32 | 206.78 | 3.61865 | 164.0062 |
| 011540787 | 1580 | 2264 | 0.6979 | 684 | 7680.46 | 11.23 | 3.92 | 652.59 | 11.420325 | 44.7146 |
| 011688323 | 553 | 604 | 0.9156 | 55 | 2126.28 | 38.66 | 12.06 | 12901.90 | 225.78325 | 2723.1489 |
| 011720712 | 1239 | 2644 | 0.4686 | 1409 | 37783.80 | 26.82 | 4.43 | 1176.45 | 20.587875 | 91.1824 |
| 011744277 | 386 | 413 | 0.9346 | 27 | 476.59 | 17.65 | 5.30 | 2160.00 | 37.8 | 200.4095 |
| 011744278 | 905 | 1124 | 0.8052 | 215 | 4571.16 | 21.26 | 6.92 | 1531.00 | 26.7925 | 185.4263 |
| 011744279 | 455 | 526 | 0.8650 | 71 | 1809.13 | 25.48 | 6.23 | 1625.00 | 28.4375 | 177.3061 |
| 011744280 | 440 | 485 | 0.9072 | 47 | 1501.08 | 31.94 | 6.66 | 1950.00 | 34.125 | 227.1316 |
| 011744281 | 726 | 866 | 0.8383 | 140 | 3528.22 | 25.20 | 6.64 | 1970.00 | 34.475 | 228.8827 |
| 011744307 | 865 | 2590 | 0.3340 | 1717 | 84982.95 | 49.50 | 5.28 | 3250.00 | 56.875 | 300.4769 |
| 011769828 | 499 | 922 | 0.5412 | 423 | 21095.51 | 49.87 | 3.55 | 893.80 | 15.6415 | 55.5123 |
| 011838164 | 979 | 1154 | 0.8484 | 175 | 3468.61 | 19.82 | 6.27 | 720.94 | 12.61645 | 79.0958 |
| 011863377 | 675 | 764 | 0.8835 | 89 | 1330.53 | 14.95 | 4.82 | 5020.49 | 87.858575 | 423.8711 |
| 011875033 | 151 | 153 | 0.9869 | 2 | 16.25 | 0.00 | 4.99 | 1449.18 | 25.36065 | 126.4346 |
| 011875041 | 877 | 1373 | 0.6387 | 503 | 15368.66 | 30.55 | 4.83 | 32920.00 | 576.1 | 2784.7590 |
| 011875188 | 594 | 671 | 0.8852 | 77 | 1704.98 | 22.14 | 6.90 | 2177.00 | 38.0975 | 262.9309 |
| 011893072 | 1281 | 1522 | 0.8417 | 241 | 7855.11 | 32.59 | 18.31 | 4698.03 | 82.215525 | 1505.1819 |
| 012034772 | 1892 | 2761 | 0.6853 | 869 | 64928.02 | 74.72 | 21.66 | 1674.95 | 29.311625 | 634.9914 |
| 012050364 | 459 | 655 | 0.7008 | 196 | 14719.48 | 75.10 | 4.16 | 10871.24 | 190.2467 | 791.3032 |
| 012050427 | 397 | 584 | 0.6798 | 187 | 16348.33 | 87.42 | 4.93 | 9889.02 | 173.05785 | 854.0010 |
| 012050456 | 526 | 589 | 0.8930 | 63 | 3753.28 | 59.58 | 15.69 | 26105.00 | 456.8375 | 7168.5139 |
| 012050795 | 303 | 303 | 1.0000 | 0 | 0.00 | 0.00 | 14.71 | 17700.00 | 309.75 | 4555.4591 |
| 012050797 | 600 | 880 | 0.6818 | 280 | 19189.21 | 68.53 | 6.69 | 14200.00 | 248.5 | 1662.2167 |
| 012050799 | 722 | 743 | 0.9717 | 21 | 142.93 | 6.81 | 3.75 | 3371.80 | 59.0065 | 221.2969 |
| 012050871 | 774 | 1473 | 0.5255 | 706 | 35542.86 | 50.34 | 4.01 | 4316.00 | 75.53 | 302.5728 |
| 012057064 | 91 | 3789 | 0.0240 | 3678 | 285689.87 | 77.68 | 2.73 | 19446.00 | 340.305 | 928.6505 |
| 012137310 | 1183 | 1396 | 0.8474 | 213 | 6784.83 | 31.85 | 17.79 | 10855.00 | 189.9625 | 3380.1979 |
| 012186385 | 620 | 1025 | 0.6049 | 405 | 10361.22 | 25.58 | 2.17 | 2587.00 | 45.2725 | 98.3937 |
| 012186392 | 1699 | 2240 | 0.7585 | 541 | 39985.89 | 73.91 | 27.38 | 6220.00 | 108.85 | 2979.9207 |
| 012194678 | 960 | 1154 | 0.8319 | 194 | 12867..42 | 66.33 | 19.68 | 14247.80 | 249.3365 | 4907.5234 |

| NIIN | Issues | Dmds | SMA | B/O's | Time in B/O | Avg Time | Avg Inv Level (Per Month) | U/P Repl $ | Hold Rt (.21/12) 0.0175 | Hld Cst |
|---|---|---|---|---|---|---|---|---|---|---|
| 012201789 | 231 | 422 | 0.5474 | 192 | 8115.55 | 42.27 | 2.23 | 11393.67 | 199.389225 | 445.3243 |
| 012294506 | 431 | 483 | 0.8923 | 52 | 500.00 | 9.62 | 2.87 | 1872.00 | 32.76 | 94.0962 |
| 012394886 | 1163 | 1964 | 0.5922 | 804 | 13684.74 | 17.02 | 4.19 | 25650.00 | 448.875 | 1881.7507 |
| 012411959 | 950 | 1984 | 0.4788 | 1034 | 18270.89 | 17.67 | 2.89 | 12124.88 | 212.1854 | 613.6449 |
| 012479676 | 439 | 560 | 0.7839 | 121 | 4900.87 | 40.50 | 3.49 | 2775.00 | 48.5625 | 169.2738 |
| 012524331 | 1169 | 1449 | 0.8068 | 280 | 4309.13 | 15.39 | 5.44 | 1760.00 | 30.8 | 167.4821 |
| 012675048 | 802 | 963 | 0.8328 | 168 | 12234.80 | 72.83 | 19.71 | 1500.00 | 26.25 | 517.3614 |
| 012675068 | 943 | 1052 | 0.8964 | 109 | 2468.73 | 22.65 | 9.85 | 1099.11 | 19.234425 | 189.5491 |
| 012763958 | 261 | 261 | 1.0000 | 0 | 0.00 | 0.00 | 79.62 | 4865.00 | 85.1375 | 6778.8625 |
| 012810084 | 568 | 625 | 0.9088 | 57 | 2259.62 | 39.64 | 12.09 | 2350.00 | 41.125 | 497.1430 |
| 012829008 | 631 | 725 | 0.8703 | 94 | 3159.44 | 33.61 | 10.48 | 788.67 | 13.801725 | 144.6073 |
| 012829115 | 676 | 746 | 0.9062 | 70 | 3029.59 | 43.28 | 14.99 | 676.20 | 11.8335 | 177.3440 |
| 012858138 | 1675 | 2219 | 0.7548 | 551 | 32024.37 | 58.12 | 19.91 | 15400.00 | 269.5 | 5364.8239 |
| 012864787 | 1420 | 1899 | 0.7478 | 479 | 36429.78 | 76.05 | 23.79 | 5040.00 | 88.2 | 2098.3835 |
| 012864789 | 489 | 564 | 0.8670 | 75 | 3806.00 | 50.75 | 15.35 | 11500.00 | 201.25 | 3089.5892 |
| 012944162 | 5338 | 6067 | 0.8798 | 732 | 15383.01 | 21.02 | 48.33 | 1406.97 | 24.621975 | 1189.9375 |
| 013048188 | 668 | 964 | 0.6929 | 296 | 9160.63 | 30.95 | 4.86 | 6367.17 | 111.425475 | 541.9880 |
| 013086683 | 682 | 749 | 0.9105 | 67 | 2742.36 | 40.93 | 13.63 | 5181.95 | 90.684125 | 1236.1750 |
| 013117486 | 8465 | 22378 | 0.3783 | 13913 | 1065453.36 | 76.58 | 37.01 | 893.15 | 15.630125 | 578.3975 |
| 013145858 | 592 | 672 | 0.8810 | 80 | 2529.09 | 31.61 | 9.77 | 690.56 | 12.0848 | 118.0336 |
| 013149207 | 349 | 369 | 0.9458 | 20 | 492.29 | 24.61 | 6.28 | 2701.19 | 47.270825 | 296.9332 |
| 013178331 | 702 | 785 | 0.8943 | 83 | 2194.71 | 26.44 | 6.50 | 7116.00 | 124.53 | 809.2339 |
| 013182610 | 2231 | 2991 | 0.7459 | 760 | 38323.87 | 50.43 | 21.88 | 12150.00 | 212.625 | 4652.6945 |
| 013186355 | 770 | 892 | 0.8632 | 122 | 5559.25 | 45.57 | 19.50 | 4140.00 | 72.45 | 1412.6122 |
| 013311678 | 386 | 425 | 0.9082 | 39 | 1601.30 | 41.06 | 10.82 | 7226.00 | 126.455 | 1367.6730 |
| 013382285 | 165 | 165 | 1.0000 | 0 | 0.00 | 0.00 | 7.64 | 30000.00 | 525 | 4012.7162 |
| 013397935 | 731 | 864 | 0.8461 | 133 | 4892.82 | 36.79 | 13.79 | 1396.14 | 24.43245 | 336.8687 |
| 013451504 | 891 | 1002 | 0.8892 | 111 | 2326.36 | 20.96 | 10.13 | 1764.00 | 30.87 | 312.8215 |
| 013456650 | 110 | 110 | 1.0000 | 0 | 0.00 | 0.00 | 7.36 | 850.00 | 14.875 | 109.5515 |
| 013456651 | 105 | 105 | 1.0000 | 0 | 0.00 | 0.00 | 4.56 | 1319.00 | 23.0825 | 105.2310 |
| 013527033 | 630 | 732 | 0.8607 | 102 | 3738.49 | 36.65 | 10.59 | 26075.00 | 456.3125 | 4832.7682 |
| 013529965 | 1560 | 2150 | 0.7256 | 592 | 19489.27 | 32.92 | 14.72 | 975.00 | 17.0625 | 251.1280 |
| 013544801 | 283 | 316 | 0.8956 | 33 | 2364.02 | 71.64 | 16.59 | 3150.00 | 55.125 | 914.5125 |
| 013622920 | 696 | 762 | 0.9134 | 66 | 2749.17 | 41.65 | 18.87 | 5731.41 | 100.299675 | 1892.7001 |
| 013722789 | 378 | 396 | 0.9545 | 18 | 465.64 | 25.87 | 5.42 | 675.00 | 11.8125 | 64.0640 |
| 013731805 | 641 | 737 | 0.8697 | 96 | 2690.91 | 28.03 | 10.83 | 2382.72 | 41.6976 | 451.5910 |
| 013731806 | 1022 | 1237 | 0.8262 | 215 | 5697.99 | 26.50 | 12.24 | 1550.00 | 27.125 | 332.0117 |
| 013758841 | 586 | 638 | 0.9185 | 52 | 1593.79 | 30.65 | 10.04 | 6295.00 | 110.1625 | 1105.6625 |
| 013904835 | 1112 | 1470 | 0.7565 | 358 | 10070.48 | 28.13 | 8.14 | 559.00 | 9.7825 | 79.6484 |
| 013909323 | 630 | 728 | 0.8654 | 98 | 2915.24 | 29.75 | 8.32 | 595.00 | 10.4125 | 86.6678 |
| 013909324 | 247 | 249 | 0.9920 | 2 | 70.16 | 35.08 | 5.66 | 559.00 | 9.7825 | 55.4108 |
| 013912116 | 699 | 767 | 0.9113 | 68 | 1884.68 | 27.72 | 10.91 | 559.00 | 9.7825 | 106.7117 |
| 013914402 | 200 | 204 | 0.9804 | 4 | 115.94 | 28.98 | 6.02 | 559.00 | 9.7825 | 58.9352 |
| 013957062 | 615 | 721 | 0.8530 | 106 | 2180.67 | 20.57 | 6.99 | 960.00 | 16.8 | 117.4038 |

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| NIIN | Issues | Dmds | SMA | B/O's | Time in B/O | Avg Time | Avg Inv Level (Per Month) | U/P Repl $ | Hold Rt (.21/12) 0.0175 | Hld Cst |
|---|---|---|---|---|---|---|---|---|---|---|
| 013985356 | 19 | 19 | 1.0000 | 0 | 0.00 | 0.00 | 5.48 | 8986.56 | 157.2648 | 861.9319 |
| 014064382 | 13 | 13 | 1.0000 | 0 | 0.00 | 0.00 | 7.02 | 2150.99 | 37.642325 | 264.2039 |
| 014074576 | 39 | 39 | 1.0000 | 0 | 0.00 | 0.00 | 6.81 | 25447.16 | 445.3253 | 3033.3505 |
| 014074634 | 916 | 1146 | 0.7993 | 230 | 5884.73 | 25.59 | 9.95 | 3591.00 | 62.8425 | 625.3421 |
| 014108253 | 122 | 122 | 1.0000 | 0 | 0.00 | 0.00 | 7.30 | 2350.99 | 41.142325 | 300.5388 |
| 014185119 | 21 | 21 | 1.0000 | 0 | 0.00 | 0.00 | 4.92 | 596.25 | 10.434375 | 51.3282 |
| 014221181 | 100 | 100 | 1.0000 | 0 | 0.00 | 0.00 | 3.42 | 750.00 | 13.125 | 44.8631 |
| 014225114 | 324 | 340 | 0.9529 | 16 | 866.27 | 54.14 | 8.61 | 1520.00 | 26.6 | 229.0100 |
| 014341799 | 87 | 87 | 1.0000 | 0 | 0.00 | 0.00 | 5.10 | 1493.76 | 26.1408 | 133.2884 |
| 014404503 | 116 | 116 | 1.0000 | 0. | 0.00 | 0.00 | 5.90 | 544.00 | 9.52 | 56.2111 |
| 014458185 | 17 | 17 | 1.0000 | 0 | 0.00 | 0.00 | 10.36 | 6419.00 | 112.3325 | 1163.4776 |
| 014466681 | 24 | 24 | 1.0000 | 0 | 0.00 | 0.00 | 9.76 | 6419.00 | 112.3325 | 1096.7634 |
| 150685523 | 893 | 1054 | 0.8472 | 161 | 4824.91 | 29.97 | 11.19 | 2514.90 | 44.01075 | 492.6943 |
| 150685525 | 10842 | 11393 | 0.9516 | 551 | 20666.93 | 37.51 | 173.41 | 149.88 | 2.6229 | 454.8257 |
| 150685585 | 4379 | 5273 | 0.8305 | 894 | 36884.74 | 41.26 | 52.16 | 5634.00 | 98.595 | 5142.6990 |
| 151004675 | 850 | 850 | 1.0000 | 0 | 0.00 | 0.00 | 138.47 | 5450.00 | 95.375 | 13206.6187 |
| 151117580 | 711 | 711 | 1.0000 | 0 | 0.00 | 0.00 | 127.43 | 3960.32 | 69.3056 | 8831.4300 |
| 997356301 | 140 | 142 | 0.9859 | 2 | 24.05 | 0.00 | 5.97 | 2419.32 | 42.3381 | 252.8425 |
| 997401343 | 945 | 1073 | 0.8807 | 128 | 4943.17 | 38.62 | 12.70 | 2929.34 | 51.26345 | 650.8236 |
| 998919977 | 1568 | 2192 | 0.7153 | 627 | 21980.13 | 35.06 | 16.02 | 478.05 | 8.365875 | 133.9915 |

| NIIN | Issues | Dmds | SMA | B/O's | Time in B/O | Avg Time | Avg Inv Level (Per Month) | U/P Repl $ | Hold Rt (.21/12) 0.0175 | Hld Cst |
|---|---|---|---|---|---|---|---|---|---|---|
| 000805166 | 1150 | 1363 | 0.8437 | 213 | 22507.03 | 23.256 | 27.97 | 3450.00 | 60.38 | 1688.74 |
| 000805211 | 875 | 1039 | 0.8422 | 164 | 15214.88 | 30.681 | 19.75 | 3037.86 | 53.16 | 1050.02 |
| 001024038 | 747 | 946 | 0.7896 | 199 | 6841.61 | 7.139 | 8.16 | 2067.81 | 36.19 | 295.15 |
| 001053214 | 2705 | 3662 | 0.7387 | 957 | 42299.14 | 26.302 | 27.50 | 767.94 | 13.44 | 369.53 |
| 001110907 | 837 | 1562 | 0.5359 | 730 | 14109.43 | 2.834 | 2.60 | 1537.80 | 26.91 | 69.90 |
| 001115706 | 940 | 1058 | 0.8885 | 118 | 4873.91 | 23.179 | 15.97 | 491.54 | 8.60 | 137.35 |
| 001122165 | 940 | 1077 | 0.8728 | 137 | 2953.40 | 11.580 | 6.78 | 1015.68 | 17.77 | 120.49 |
| 002185956 | 1389 | 1696 | 0.8190 | 307 | 26240.86 | 28.044 | 33.58 | 6346.00 | 111.06 | 3728.94 |
| 003172349 | 782 | 893 | 0.8757 | 111 | 5495.52 | 13.504 | 15.77 | 1746.00 | 30.56 | 481.76 |
| 004766898 | 1422 | 1722 | 0.8258 | 300 | 25334.70 | 31.543 | 38.33 | 3073.77 | 53.79 | 2061.98 |
| 005557358 | 888 | 1055 | 0.8417 | 168 | 1978.69 | 3.415 | 3.00 | 4134.25 | 72.35 | 216.81 |
| 005557414 | 7160 | 11429 | 0.6265 | 4269 | 149863.96 | 41.735 | 32.80 | 2747.76 | 48.09 | 1576.99 |
| 005557906 | 341 | 354 | 0.9633 | 13 | 355.82 | 5.663 | 4.44 | 11650.99 | 203.89 | 905.09 |
| 005759297 | 7631 | 11285 | 0.6762 | 3654 | 198946.61 | 83.682 | 58.89 | 1620.72 | 28.36 | 1670.18 |
| 005966273 | 632 | 733 | 0.8622 | 101 | 1451.28 | 3.370 | 3.02 | 2081.00 | 36.42 | 110.03 |
| 005966274 | 634 | 728 | 0.8709 | 90 | 1695.87 | 4.523 | 4.06 | 2084.00 | 36.47 | 148.15 |
| 005966475 | 564 | 609 | 0.9261 | 44 | 1090.89 | 7.076 | 5.69 | 1260.59 | 22.06 | 125.44 |
| 006011040 | 527 | 568 | 0.9278 | 41 | 1003.82 | 5.981 | 6.12 | 883.00 | 15.45 | 94.58 |
| 006011236 | 2338 | 3138 | 0.7451 | 794 | 11157.07 | 7.753 | 6.56 | 1947.84 | 34.09 | 223.64 |
| 006011294 | 1098 | 1492 | 0.7359 | 394 | 4581.53 | 4.105 | 4.03 | 484.92 | 8.49 | 34.16 |
| 006011365 | 1256 | 1487 | 0.8447 | 237 | 8933.94 | 19.861 | 15.35 | 1519.40 | 26.59 | 408.16 |
| 006011412 | 1872 | 3463 | 0.5406 | 1591 | 22412.73 | 6.342 | 4.35 | 1005.96 | 17.60 | 76.65 |
| 006011423 | 1448 | 2011 | 0.7200 | 563 | 4757.26 | 4.241 | 3.37 | 819.00 | 14.33 | 48.30 |
| 006011563 | 320 | 340 | 0.9412 | 20 | 529.48 | 6.476 | 5.41 | 1453.69 | 25.44 | 137.68 |
| 006026779 | 750 | 1113 | 0.6739 | 363 | 7992.28 | 3.916 | 3.60 | 2076.00 | 36.33 | 130.65 |
| 006026786 | 859 | 1108 | 0.7753 | 249 | 5398.26 | 5.280 | 5.23 | 1559.00 | 27.28 | 142.82 |
| 006026815 | 994 | 1273 | 0.7808 | 280 | 7665.79 | 3.846 | 3.15 | 2517.70 | 44.06 | 138.68 |
| 006026823 | 1278 | 1719 | 0.7435 | 441 | 5734.21 | 3.873 | 3.96 | 1257.00 | 22.00 | 87.08 |
| 006026836 | 1741 | 1897 | 0.9178 | 156 | 1183.95 | 4.957 | 5.05 | 878.35 | 15.37 | 77.58 |
| 006137235 | 3889 | 5124 | 0.7564 | 1235 | 58839.93 | 35.562 | 35.12 | 821.23 | 14.37 | 504.67 |
| 006137243 | 828 | 1023 | 0.8094 | 195 | 12440.12 | 20.378 | 16.51 | 20590.72 | 360.34 | 5947.50 |
| 006137244 | 806 | 991 | 0.8133 | 185 | 5309.01 | 7.862 | 7.46 | 6707.00 | 117.37 | 875.33 |
| 006137245 | 2586 | 3269 | 0.7911 | 688 | 41220.34 | 35.769 | 37.29 | 5165.00 | 90.39 | 3370.68 |
| 008707009 | 496 | 613 | 0.8091 | 117 | 8751.41 | 10.256 | 9.07 | 12213.50 | 213.74 | 1939.30 |
| 009460294 | 1532 | 1973 | 0.7765 | 441 | 13368.92 | 12.144 | 10.35 | 1242.00 | 21.74 | 224.94 |
| 010036797 | 2851 | 3581 | 0.7961 | 730 | 38562.02 | 46.317 | 40.07 | 3647.77 | 63.84 | 2558.20 |
| 010066270 | 477 | 526 | 0.9068 | 49 | 1328.45 | 7.933 | 5.62 | 9597.39 | 167.95 | 943.60 |
| 010090517 | 592 | 678 | 0.8732 | 86 | 3418.10 | 26.149 | 16.19 | 649.00 | 11.36 | 183.91 |
| 010157346 | 956 | 1170 | 0.8171 | 214 | 6206.32 | 15.359 | 8.97 | 11450.00 | 200.38 | 1797.28 |
| 010157451 | 4537 | 6554 | 0.6922 | 2017 | 134718.78 | 80.544 | 63.10 | 1449.36 | 25.36 | 1600.50 |
| 010157615 | 1822 | 3073 | 0.5929 | 1253 | 20764.79 | 7.932 | 5.03 | 1154.99 | 20.21 | 101.69 |
| 010157617 | 1327 | 1653 | 0.8028 | 326 | 3460.99 | 4.301 | 3.91 | 1378.00 | 24.12 | 94.18 |
| 010157619 | 192 | 278 | 0.6906 | 86 | 1903.14 | 1.591 | 0.79 | 655.77 | 11.48 | 9.04 |

| NIIN | Issues | Dmds | SMA | B/O's | Time in B/O | Avg Time | Avg Inv Level (Per Month) | U/P Repl $ | Hold Rt (.21/12) 0.0175 | Hld Cst |
|------|--------|------|-----|-------|-------------|----------|---------------------------|------------|--------------------------|---------|
| 010166232 | 1181 | 1443 | 0.8184 | 266 | 4637.21 | 8.339 | 6.53 | 780.55 | 13.66 | 89.22 |
| 010166236 | 589 | 763 | 0.7720 | 174 | 3131.19 | 2.962 | 2.01 | 720.94 | 12.62 | 25.40 |
| 010256020 | 491 | 621 | 0.7907 | 130 | 2630.22 | 2.846 | 2.16 | 886.74 | 15.52 | 33.59 |
| 010263950 | 1454 | 2623 | 0.5543 | 1169 | 19111.97 | 4.644 | 4.00 | 580.00 | 10.15 | 40.57 |
| 010263956 | 464 | 503 | 0.9225 | 39 | 903.12 | 4.999 | 4.49 | 871.38 | 15.25 | 68.54 |
| 010263958 | 492 | 584 | 0.8425 | 92 | 2383.26 | 5.731 | 3.75 | 528.16 | 9.24 | 34.65 |
| 010263961 | 969 | 1203 | 0.8055 | 234 | 4664.13 | 5.167 | 4.10 | 871.00 | 15.24 | 62.48 |
| 010263963 | 485 | 530 | 0.9151 | 45 | 628.45 | 2.649 | 2.45 | 501.00 | 8.77 | 21.46 |
| 010300091 | 2602 | 3349 | 0.7769 | 760 | 50899.16 | 36.646 | 39.46 | 876.49 | 15.34 | 605.21 |
| 010317639 | 1140 | 1384 | 0.8237 | 244 | 8950.72 | 9.562 | 10.01 | 35050.00 | 613.38 | 6137.69 |
| 010328875 | 660 | 735 | 0.8980 | 75 | 2385.91 | 12.424 | 9.52 | 2283.00 | 39.95 | 380.23 |
| 010329624 | 1023 | 1251 | 0.8177 | 228 | 2503.63 | 2.589 | 2.65 | 539.21 | 9.44 | 25.00 |
| 010329693 | 737 | 900 | 0.8189 | 163 | 2210.60 | 3.103 | 2.84 | 544.90 | 9.54 | 27.12 |
| 010329694 | 734 | 903 | 0.8128 | 169 | 6135.12 | 8.427 | 5.79 | 2188.90 | 38.31 | 221.86 |
| 010337454 | 844 | 968 | 0.8719 | 124 | 3039.68 | 8.684 | 7.22 | 795.83 | 13.93 | 100.57 |
| 010380313 | 898 | 1040 | 0.8635 | 142 | 5712.68 | 11.531 | 11.10 | 707.95 | 12.39 | 137.55 |
| 010395544 | 5324 | 5955 | 0.8940 | 631 | 3096.22 | 9.616 | 8.05 | 830.00 | 14.53 | 116.94 |
| 010395549 | 1110 | 1469 | 0.7556 | 353 | 14027.34 | 8.193 | 8.53 | 462.00 | 8.09 | 68.97 |
| 010395551 | 1617 | 2074 | 0.7797 | 464 | 16228.06 | 14.692 | 14.33 | 889.53 | 15.57 | 223.03 |
| 010395555 | 1334 | 1593 | 0.8374 | 259 | 6422.43 | 11.547 | 8.81 | 801.00 | 14.02 | 123.46 |
| 010395556 | 437 | 462 | 0.9459 | 25 | 635.66 | 6.877 | 5.79 | 544.00 | 9.52 | 55.16 |
| 010395580 | 385 | 587 | 0.6559 | 200 | 2678.23 | 1.595 | 1.49 | 544.35 | 9.53 | 14.15 |
| 010395592 | 19427 | 25640 | 0.7577 | 6237 | 28723.57 | 28.142 | 16.86 | 850.00 | 14.88 | 250.79 |
| 010395593 | 1359 | 1605 | 0.8467 | 246 | 5794.79 | 9.820 | 9.21 | 643.00 | 11.25 | 103.65 |
| 010400355 | 919 | 1415 | 0.6495 | 496 | 11780.23 | 4.522 | 3.87 | 950.07 | 16.63 | 64.31 |
| 010402651 | 692 | 823 | 0.8408 | 131 | 2861.39 | 5.206 | 3.75 | 703.24 | 12.31 | 46.16 |
| 010466624 | 467 | 509 | 0.9175 | 46 | 3005.05 | 17.888 | 15.22 | 6925.00 | 121.19 | 1844.19 |
| 010466662 | 401 | 438 | 0.9155 | 37 | 1114.62 | 5.354 | 6.02 | 4300.00 | 75.25 | 452.78 |
| 010466666 | 718 | 914 | 0.7856 | 196 | 2590.11 | 3.023 | 2.44 | 6714.00 | 117.50 | 286.63 |
| 010466703 | 575 | 670 | 0.8582 | 95 | 1944.05 | 4.410 | 2.71 | 905.37 | 15.84 | 42.98 |
| 010466711 | 614 | 757 | 0.8111 | 143 | 3202.77 | 4.171 | 4.27 | 1601.54 | 28.03 | 119.63 |
| 010474930 | 1306 | 1842 | 0.7090 | 536 | 15269.80 | 6.950 | 4.92 | 6492.00 | 113.61 | 559.24 |
| 010474977 | 976 | 1192 | 0.8188 | 216 | 6967.31 | 8.510 | 6.74 | 677.16 | 11.85 | 79.88 |
| 010474978 | 354 | 425 | 0.8329 | 71 | 6769.48 | 7.513 | 7.41 | 2059.00 | 36.03 | 266.84 |
| 010475007 | 2274 | 2475 | 0.9188 | 201 | 1264.42 | 5.263 | 4.97 | 617.55 | 10.81 | 53.67 |
| 010475018 | 839 | 1098 | 0.7641 | 259 | 7261.17 | 8.252 | 4.35 | 1238.82 | 21.68 | 94.27 |
| 010475020 | 752 | 871 | 0.8634 | 119 | 5950.77 | 11.079 | 11.33 | 758.20 | 13.27 | 150.33 |
| 010484634 | 391 | 436 | 0.8968 | 45 | 723.78 | 2.410 | 2.31 | 1564.00 | 27.37 | 63.10 |
| 010484647 | 476 | 585 | 0.8137 | 109 | 1920.25 | 3.447 | 2.62 | 1723.17 | 30.16 | 79.01 |
| 010501356 | 786 | 845 | 0.9302 | 59 | 685.16 | 4.634 | 4.47 | 2034.00 | 35.60 | 159.06 |
| 010501361 | 4332 | 6456 | 0.6710 | 2137 | 25874.81 | 12.579 | 8.10 | 2687.00 | 47.02 | 380.84 |
| 010501362 | 2945 | 3999 | 0.7364 | 1088 | 111744.26 | 53.373 | 61.53 | 2622.84 | 45.90 | 2824.42 |
| 010501685 | 2978 | 4299 | 0.6927 | 1321 | 23648.40 | 11.945 | 7.54 | 2815.78 | 49.28 | 371.35 |

| NIIN | Issues | Dmds | SMA | B/O's | Time in B/O | Avg Time | Avg Inv Level (Per Month) | U/P Repl $ | Hold Rt (.21/12) 0.0175 | Hld Cst |
|---|---|---|---|---|---|---|---|---|---|---|
| 010507648 | 513 | 636 | 0.8066 | 125 | 1853.05 | 1.657 | 1.99 | 1600.00 | 28.00 | 55.77 |
| 010515449 | 1172 | 1468 | 0.7984 | 297 | 17856.87 | 21.126 | 20.96 | 3100.00 | 54.25 | 1136.88 |
| 010521552 | 1299 | 1597 | 0.8134 | 299 | 24429.14 | 32.789 | 35.04 | 1092.00 | 19.11 | 669.62 |
| 010543301 | 1148 | 1495 | 0.7679 | 349 | 9378.93 | 8.044 | 6.72 | 72982.00 | 1277.19 | 8580.55 |
| 010603341 | 598 | 693 | 0.8629 | 97 | 1985.29 | 5.534 | 5.02 | 672.50 | 11.77 | 59.06 |
| 010603344 | 1531 | 1562 | 0.9802 | 31 | 116.82 | 4.362 | 4.76 | 537.30 | 9.40 | 44.75 |
| 010603348 | 2666 | 3701 | 0.7203 | 1035 | 10427.79 | 6.953 | 7.57 | 474.11 | 8.30 | 62.80 |
| 010624141 | 514 | 565 | 0.9097 | 51 | 1623.17 | 9.611 | 8.07 | 12228.00 | 213.99 | 1727.27 |
| 010628605 | 2414 | 4436 | 0.5442 | 2022 | 31815.76 | 9.210 | 5.41 | 392.00 | 6.86 | 37.11 |
| 010629351 | 536 | 559 | 0.9589 | 23 | 1413.18 | 36.360 | 20.98 | 2600.60 | 45.51 | 954.59 |
| 010629365 | 2388 | 3303 | 0.7230 | 915 | 8748.51 | 6.666 | 6.11 | 539.31 | 9.44 | 57.71 |
| 010640485 | 3507 | 5839 | 0.6006 | 2332 | 126672.69 | 70.363 | 20.30 | 698.58 | 12.23 | 248.23 |
| 010658297 | 16900 | 22504 | 0.7510 | 5604 | 284971.14 | 237.279 | 129.42 | 611.71 | 10.70 | 1385.47 |
| 010670473 | 913 | 1235 | 0.7393 | 325 | 6506.91 | 4.471 | 3.75 | 1326.00 | 23.21 | 87.06 |
| 010684706 | 642 | 691 | 0.9291 | 49 | 1315.53 | 11.102 | 10.25 | 4547.00 | 79.57 | 815.28 |
| 010685010 | 502 | 633 | 0.7930 | 131 | 12222.91 | 9.822 | 12.77 | 8571.66 | 150.00 | 1916.06 |
| 010691903 | 782 | 870 | 0.8989 | 88 | 2630.07 | 8.611 | 6.97 | 3295.00 | 57.66 | 402.10 |
| 010694631 | 1702 | 2085 | 0.8163 | 383 | 3791.54 | 3.771 | 4.23 | 5464.00 | 95.62 | 404.51 |
| 010694632 | 1815 | 2515 | 0.7217 | 705 | 7789.77 | 4.575 | 4.18 | 4691.00 | 82.09 | 342.95 |
| 010761346 | 1558 | 2066 | 0.7541 | 508 | 10579.49 | 7.969 | 6.05 | 2831.59 | 49.55 | 299.75 |
| 010875292 | 1837 | 2413 | 0.7613 | 576 | 50976.01 | 44.044 | 34.39 | 578.43 | 10.12 | 348.11 |
| 010881426 | 2619 | 3884 | 0.6743 | 1265 | 39875.60 | 19.286 | 12.21 | 1033.90 | 18.09 | 221.01 |
| 010898895 | 6638 | 8922 | 0.7440 | 2284 | 187709.69 | 133.889 | 99.65 | 635.37 | 11.12 | 1108.01 |
| 010914361 | 1683 | 2156 | 0.7806 | 454 | 27615.32 | 31.860 | 27.26 | 2747.76 | 48.09 | 1310.62 |
| 010931283 | 47067 | 66635 | 0.7063 | 19568 | 1175952.41 | 424.516 | 295.51 | 134.13 | 2.35 | 693.64 |
| 010931372 | 3680 | 4798 | 0.7670 | 1117 | 7645.43 | 6.562 | 4.89 | 6318.00 | 110.57 | 540.34 |
| 010931468 | 2128 | 2728 | 0.7801 | 600 | 28321.40 | 20.397 | 20.54 | 4478.00 | 78.37 | 1609.27 |
| 010942520 | 2662 | 3527 | 0.7547 | 865 | 30875.26 | 19.798 | 20.08 | 1378.54 | 24.12 | 484.53 |
| 010942577 | 766 | 847 | 0.9044 | 77 | 2220.71 | 12.284 | 9.80 | 1285.39 | 22.49 | 220.41 |
| 010942819 | 1728 | 2271 | 0.7609 | 543 | 11877.81 | 9.425 | 6.88 | 814.90 | 14.26 | 98.07 |
| 010992869 | 444 | 465 | 0.9548 | 21 | 774.52 | 13.489 | 9.48 | 677.00 | 11.85 | 112.36 |
| 010992871 | 663 | 765 | 0.8667 | 102 | 2503.85 | 6.087 | 6.88 | 359.54 | 6.29 | 43.28 |
| 011000306 | 561 | 759 | 0.7391 | 196 | 16594.84 | 10.450 | 9.88 | 22254.20 | 389.45 | 3848.34 |
| 011026824 | 2962 | 3529 | 0.8393 | 567 | 41520.05 | 51.870 | 63.28 | 2094.25 | 36.65 | 2319.33 |
| 011029486 | 524 | 594 | 0.8822 | 70 | 1079.59 | 2.995 | 2.68 | 1365.55 | 23.90 | 64.14 |
| 011110558 | 10083 | 12906 | 0.7813 | 2853 | 230121.62 | 102.231 | 84.43 | 709.48 | 12.42 | 1048.31 |
| 011167167 | 312 | 380 | 0.8211 | 68 | 1333.96 | 1.868 | 1.26 | 1411.29 | 24.70 | 31.20 |
| 011167313 | 14686 | 19065 | 0.7703 | 4372 | 302907.74 | 162.163 | 183.31 | 1354.32 | 23.70 | 4344.45 |
| 011172219 | 1229 | 1589 | 0.7734 | 360 | 24892.26 | 22.454 | 17.89 | 2120.89 | 37.12 | 663.81 |
| 011175564 | 15332 | 20875 | 0.7345 | 5658 | 389543.11 | 239.100 | 196.57 | 2054.16 | 35.95 | 7066.32 |
| 011179931 | 1215 | 1525 | 0.7967 | 310 | 16721.19 | 13.679 | 14.67 | 4079.73 | 71.40 | 1047.64 |
| 011285343 | 1655 | 2164 | 0.7648 | 521 | 39936.10 | 21.049 | 23.68 | 3181.00 | 55.67 | 1318.42 |
| 011305743 | 1608 | 2055 | 0.7825 | 447 | 17334.82 | 15.160 | 15.14 | 4602.00 | 80.54 | 1219.13 |

| NIIN | Issues | Dmds | SMA | B/O's | Time in B/O | Avg Time | Avg Inv Level | U/P Repl $ | Hold Rt (.21/12) | Hld Cst |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | (Per Month) | | 0.0175 | |
| 011306050 | 387 | 429 | 0.9021 | 42 | 2364.64 | 14.576 | 10.38 | 1538.50 | 26.92 | 279.55 |
| 011306053 | 883 | 1028 | 0.8589 | 145 | 7020.08 | 26.015 | 16.26 | 1492.12 | 26.11 | 424.67 |
| 011346899 | 1764 | 2251 | 0.7837 | 487 | 27738.46 | 21.462 | 24.76 | 1424.88 | 24.94 | 617.49 |
| 011349738 | 117 | 117 | 1.0000 | 0 | 0.00 | 8.769 | 6.61 | 3765.00 | 65.89 | 435.35 |
| 011349739 | 3882 | 5142 | 0.7550 | 1260 | 58959.47 | 32.722 | 34.54 | 4525.00 | 79.19 | 2735.25 |
| 011349740 | 151 | 151 | 1.0000 | 0 | 0.00 | 3.324 | 3.14 | 5856.00 | 102.48 | 321.36 |
| 011349756 | 1845 | 2311 | 0.7984 | 473 | 19066.66 | 21.602 | 21.10 | 5882.00 | 102.94 | 2171.64 |
| 011356458 | 2731 | 3656 | 0.7470 | 914 | 32557.83 | 23.158 | 19.47 | 4184.00 | 73.22 | 1425.95 |
| 011368496 | 1157 | 1359 | 0.8514 | 202 | 2388.44 | 5.150 | 4.26 | 1272.00 | 22.26 | 94.88 |
| 011380217 | 1254 | 1550 | 0.8090 | 296 | 9622.85 | 22.525 | 12.21 | 2494.00 | 43.65 | 533.09 |
| 011380224 | 411 | 440 | 0.9341 | 29 | 576.88 | 6.662 | 5.30 | 570.98 | 9.99 | 52.97 |
| 011428662 | 622 | 768 | 0.8099 | 146 | 3603.80 | 5.678 | 4.42 | 6281.25 | 109.92 | 486.34 |
| 011483400 | 904 | 1067 | 0.8472 | 161 | 4210.19 | 7.892 | 5.27 | 1361.31 | 23.82 | 125.65 |
| 011498996 | 34839 | 52040 | 0.6695 | 17201 | 667231.56 | 249.438 | 194.44 | 134.13 | 2.35 | 456.40 |
| 011498997 | 27914 | 44314 | 0.6299 | 16255 | 551472.44 | 220.485 | 178.45 | 135.06 | 2.36 | 421.78 |
| 011498998 | 30941 | 45341 | 0.6824 | 14722 | 560672.80 | 228.908 | 207.20 | 111.36 | 1.95 | 403.80 |
| 011498999 | 24599 | 38450 | 0.6398 | 13851 | 492877.08 | 201.603 | 143.78 | 154.95 | 2.71 | 389.88 |
| 011499000 | 21008 | 32644 | 0.6435 | 11851 | 426414.23 | 156.404 | 135.73 | 206.78 | 3.62 | 491.15 |
| 011540787 | 1487 | 2155 | 0.6900 | 668 | 8724.14 | 4.118 | 3.63 | 652.59 | 11.42 | 41.45 |
| 011688323 | 603 | 673 | 0.8960 | 74 | 3678.21 | 13.364 | 13.42 | 12901.90 | 225.78 | 3030.19 |
| 011720712 | 1908 | 2648 | 0.7205 | 740 | 21019.32 | 11.385 | 10.66 | 1176.45 | 20.59 | 219.54 |
| 011744277 | 385 | 411 | 0.9367 | 26 | 826.41 | 5.173 | 4.80 | 2160.00 | 37.80 | 181.55 |
| 011744278 | 876 | 1126 | 0.7780 | 250 | 7677.07 | 9.541 | 8.26 | 1531.00 | 26.79 | 221.31 |
| 011744279 | 461 | 520 | 0.8865 | 59 | 1495.64 | 6.322 | 5.93 | 1625.00 | 28.44 | 168.72 |
| 011744280 | 482 | 529 | 0.9112 | 47 | 1860.05 | 6.432 | 6.38 | 1950.00 | 34.13 | 217.60 |
| 011744281 | 685 | 799 | 0.8573 | 114 | 2825.72 | 6.596 | 6.16 | 1970.00 | 34.48 | 212.22 |
| 011744307 | 1961 | 2544 | 0.7708 | 583 | 29243.54 | 17.010 | 20.94 | 3250.00 | 56.88 | 1190.76 |
| 011769828 | 831 | 1038 | 0.8006 | 207 | 10154.85 | 8.005 | 8.23 | 893.80 | 15.64 | 128.78 |
| 011838164 | 960 | 1144 | 0.8392 | 184 | 4102.92 | 7.162 | 5.87 | 720.94 | 12.62 | 74.06 |
| 011863377 | 649 | 751 | 0.8642 | 102 | 1490.09 | 4.636 | 3.76 | 5020.49 | 87.86 | 330.72 |
| 011875033 | 151 | 153 | 0.9869 | 2 | 16.25 | 4.892 | 4.62 | 1449.18 | 25.36 | 117.07 |
| 011875041 | 1067 | 1412 | 0.7557 | 345 | 12370.72 | 9.341 | 9.31 | 32920.00 | 576.10 | 5363.10 |
| 011875188 | 651 | 737 | 0.8833 | 86 | 1980.66 | 6.828 | 6.75 | 2177.00 | 38.10 | 257.11 |
| 011893072 | 1316 | 1533 | 0.8584 | 217 | 8268.93 | 15.681 | 15.55 | 4698.03 | 82.22 | 1278.63 |
| 012034772 | 2121 | 2676 | 0.7926 | 555 | 40616.28 | 34.863 | 41.63 | 1674.95 | 29.31 | 1220.27 |
| 012050364 | 504 | 633 | 0.7962 | 129 | 10781.49 | 9.688 | 7.39 | 10871.24 | 190.25 | 1405.82 |
| 012050427 | 502 | 604 | 0.8311 | 102 | 7880.45 | 6.126 | 8.33 | 9889.02 | 173.06 | 1441.12 |
| 012050456 | 573 | 642 | 0.8925 | 69 | 4399.95 | 16.384 | 20.25 | 26105.00 | 456.84 | 9251.45 |
| 012050795 | 280 | 280 | 1.0000 | 0 | 0.00 | 11.840 | 10.25 | 17700.00 | 309.75 | 3176.29 |
| 012050797 | 673 | 819 | 0.8217 | 156 | 12098.31 | 14.846 | 13.23 | 14200.00 | 248.50 | 3287.35 |
| 012050799 | 0 | 780 | 0.0000 | 777 | 21230.59 | 3.457 | 0.80 | 3371.80 | 59.01 | 47.39 |
| 012050871 | 1095 | 1442 | 0.7594 | 347 | 24962.89 | 26.169 | 16.52 | 4316.00 | 75.53 | 1248.03 |
| 012057064 | 2813 | 3795 | 0.7412 | 982 | 25414.65 | 17.042 | 13.10 | 19446.00 | 340.31 | 4458.77 |

| NIIN | Issues | Dmds | SMA | B/O's | Time in B/O | Avg Time | Avg Inv Level (Per Month) | U/P Repl $ | Hold Rt (.21/12) 0.0175 | Hld Cst |
|---|---|---|---|---|---|---|---|---|---|---|
| 012137310 | 1263 | 1457 | 0.8668 | 194 | 8312.65 | 21.272 | 18.26 | 10855.00 | 189.96 | 3468.49 |
| 012186385 | 768 | 943 | 0.8144 | 175 | 5093.97 | 6.603 | 5.56 | 2587.00 | 45.27 | 251.84 |
| 012186392 | 1742 | 2170 | 0.8028 | 428 | 28920.51 | 45.153 | 33.34 | 6220.00 | 108.85 | 3628.85 |
| 012194678 | 950 | 1168 | 0.8134 | 218 | 17411.59 | 23.802 | 20.02 | 14247.80 | 249.34 | 4992.96 |
| 012201789 | 382 | 467 | 0.8180 | 85 | 5074.08 | 7.403 | 4.82 | 11393.67 | 199.39 | 960.44 |
| 012294506 | 463 | 506 | 0.9150 | 43 | 458.47 | 2.687 | 2.44 | 1872.00 | 32.76 | 79.81 |
| 012394886 | 1406 | 1881 | 0.7475 | 475 | 9040.41 | 7.581 | 5.76 | 25650.00 | 448.88 | 2584.20 |
| 012411959 | 1324 | 1987 | 0.6663 | 663 | 11257.50 | 5.485 | 3.88 | 12124.88 | 212.19 | 822.26 |
| 012479676 | 469 | 569 | 0.8243 | 100 | 3709.96 | 7.906 | 4.81 | 2775.00 | 48.56 | 233.45 |
| 012524331 | 1128 | 1372 | 0.8222 | 244 | 4210.62 | 5.386 | 5.32 | 1760.00 | 30.80 | 163.72 |
| 012675048 | 866 | 1083 | 0.7996 | 223 | 16838.52 | 23.194 | 18.95 | 1500.00 | 26.25 | 497.51 |
| 012675068 | 1052 | 1170 | 0.8991 | 118 | 3250.28 | 10.686 | 8.79 | 1099.11 | 19.23 | 169.10 |
| 012763958 | 208 | 208 | 1.0000 | 0 | 0.00 | 72.986 | 15.41 | 4865.00 | 85.14 | 1311.72 |
| 012810084 | 581 | 637 | 0.9121 | 56 | 2596.40 | 15.740 | 12.16 | 2350.00 | 41.13 | 500.28 |
| 012829008 | 730 | 814 | 0.8968 | 84 | 2856.86 | 9.270 | 9.64 | 788.67 | 13.80 | 132.99 |
| 012829115 | 639 | 716 | 0.8925 | 77 | 3358.65 | 13.865 | 11.83 | 676.20 | 11.83 | 139.97 |
| 012858138 | 1766 | 2209 | 0.7995 | 443 | 27543.75 | 34.180 | 28.11 | 15400.00 | 269.50 | 7574.35 |
| 012864787 | 1510 | 1926 | 0.7840 | 416 | 37092.70 | 33.599 | 30.45 | 5040.00 | 88.20 | 2685.99 |
| 012864789 | 484 | 547 | 0.8848 | 63 | 4832.99 | 17.767 | 16.76 | 11500.00 | 201.25 | 3372.20 |
| 012944162 | 5414 | 6037 | 0.8968 | 623 | 12286.26 | 100.684 | 48.86 | 1406.97 | 24.62 | 1202.97 |
| 013048188 | 769 | 986 | 0.7799 | 217 | 6425.06 | 7.492 | 5.73 | 6367.17 | 111.43 | 638.94 |
| 013086683 | 706 | 812 | 0.8695 | 106 | 3565.32 | 16.626 | 14.04 | 5181.95 | 90.68 | 1273.31 |
| 013117486 | 16545 | 21682 | 0.7631 | 5137 | 482409.65 | 349.143 | 95.24 | 893.15 | 15.63 | 1488.55 |
| 013145858 | 513 | 562 | 0.9128 | 49 | 1741.83 | 11.489 | 10.04 | 690.56 | 12.08 | 121.39 |
| 013149207 | 311 | 340 | 0.9147 | 29 | 704.30 | 7.020 | 5.86 | 2701.19 | 47.27 | 277.23 |
| 013178331 | 717 | 795 | 0.9019 | 78 | 2279.65 | 8.531 | 7.28 | 7116.00 | 124.53 | 906.07 |
| 013182610 | 2313 | 3025 | 0.7646 | 716 | 31169.95 | 37.196 | 26.66 | 12150.00 | 212.63 | 5668.05 |
| 013186355 | 786 | 899 | 0.8743 | 113 | 6531.08 | 21.965 | 15.66 | 4140.00 | 72.45 | 1134.70 |
| 013311678 | 426 | 467 | 0.9122 | 41 | 2472.54 | 12.143 | 14.98 | 7226.00 | 126.46 | 1893.72 |
| 013382285 | 169 | 170 | 0.9941 | 1 | 77.10 | 10.174 | 7.81 | 30000.00 | 525.00 | 4098.48 |
| 013397935 | 694 | 782 | 0.8875 | 88 | 4359.86 | 13.574 | 11.88 | 1396.14 | 24.43 | 290.16 |
| 013451504 | 924 | 1031 | 0.8962 | 107 | 3164.59 | 11.087 | 9.11 | 1764.00 | 30.87 | 281.22 |
| 013456650 | 119 | 119 | 1.0000 | 0 | 0.00 | 8.888 | 6.12 | 850.00 | 14.88 | 91.04 |
| 013456651 | 105 | 105 | 1.0000 | 0 | 0.00 | 4.775 | 4.81 | 1319.00 | 23.08 | 111.03 |
| 013527033 | 622 | 704 | 0.8835 | 82 | 3073.61 | 11.944 | 9.00 | 26075.00 | 456.31 | 4108.23 |
| 013529965 | 1646 | 1990 | 0.8271 | 344 | 12634.04 | 22.421 | 14.95 | 975.00 | 17.06 | 255.13 |
| 013544801 | 298 | 325 | 0.9169 | 27 | 3148.85 | 13.086 | 16.36 | 3150.00 | 55.13 | 901.81 |
| 013622920 | 684 | 758 | 0.9024 | 74 | 4134.69 | 19.028 | 20.62 | 5731.41 | 100.30 | 2067.90 |
| 013722789 | 414 | 450 | 0.9200 | 36 | 1010.69 | 7.151 | 5.91 | 675.00 | 11.81 | 69.86 |
| 013731805 | 705 | 809 | 0.8714 | 104 | 2811.39 | 9.520 | 8.74 | 2382.72 | 41.70 | 364.44 |
| 013731806 | 1090 | 1339 | 0.8140 | 249 | 7885.81 | 14.798 | 12.48 | 1550.00 | 27.13 | 338.43 |
| 013758841 | 597 | 655 | 0.9115 | 58 | 1925.11 | 11.392 | 8.86 | 6295.00 | 110.16 | 976.32 |
| 013904835 | 1087 | 1392 | 0.7809 | 301 | 9144.20 | 13.607 | 8.11 | 559.00 | 9.78 | 79.31 |

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|------|--------|------|-----|-------|-------------|----------|---------------------------|------------|-------------------------|---------|
| 013909323 | 630 | 723 | 0.8714 | 93 | 3162.68 | 10.674 | 8.43 | 595.00 | 10.41 | 87.73 |
| 013909324 | 225 | 232 | 0.9698 | 7 | 193.09 | 8.150 | 5.92 | 559.00 | 9.78 | 57.95 |
| 013912116 | 680 | 767 | 0.8866 | 87 | 3072.94 | 14.740 | 10.67 | 559.00 | 9.78 | 104.35 |
| 013914402 | 198 | 200 | 0.9900 | 2 | 86.66 | 8.125 | 5.87 | 559.00 | 9.78 | 57.39 |
| 013957062 | 678 | 768 | 0.8828 | 90 | 2555.63 | 12.931 | 5.75 | 960.00 | 16.80 | 96.58 |
| 013985356 | 19 | 19 | 1.0000 | 0 | 0.00 | 5.859 | 5.07 | 8986.56 | 157.26 | 798.09 |
| 014064382 | 13 | 13 | 1.0000 | 0 | 0.00 | 6.309 | 6.50 | 2150.99 | 37.64 | 244.63 |
| 014074576 | 39 | 39 | 1.0000 | 0 | 0.00 | 5.314 | 6.31 | 25447.16 | 445.33 | 2808.66 |
| 014074634 | 922 | 1095 | 0.8420 | 173 | 6049.41 | 12.836 | 10.94 | 3591.00 | 62.84 | 687.58 |
| 014108253 | 122 | 122 | 1.0000 | 0 | 0.00 | 5.949 | 6.75 | 2350.99 | 41.14 | 277.84 |
| 014185119 | 21 | 21 | 1.0000 | 0 | 0.00 | 5.678 | 4.55 | 596.25 | 10.43 | 47.53 |
| 014221181 | 100 | 100 | 1.0000 | 0 | 0.00 | 3.240 | 3.13 | 750.00 | 13.13 | 41.08 |
| 014225114 | 309 | 331 | 0.9335 | 22 | 1002.65 | 11.086 | 7.76 | 1520.00 | 26.60 | 206.30 |
| 014341799 | 87 | 87 | 1.0000 | 0 | 0.00 | 4.680 | 4.37 | 1493.76 | 26.14 | 114.29 |
| 014404503 | 116 | 116 | 1.0000 | 0 | 0.00 | 4.572 | 5.47 | 544.00 | 9.52 | 52.05 |
| 014458185 | 17 | 17 | 1.0000 | 0 | 0.00 | 9.043 | 9.59 | 6419.00 | 112.33 | 1077.29 |
| 014466681 | 24 | 24 | 1.0000 | 0 | 0.00 | 9.043 | 9.04 | 6419.00 | 112.33 | 1015.52 |
| 150685523 | 865 | 982 | 0.8809 | 112 | 3966.28 | 17.066 | 9.34 | 2514.90 | 44.01 | 411.16 |
| 150685525 | 10274 | 11765 | 0.8733 | 1536 | 58928.92 | 212.966 | 105.34 | 149.88 | 2.62 | 276.29 |
| 150685585 | 4752 | 5947 | 0.7991 | 1187 | 41747.57 | 55.173 | 41.16 | 5634.00 | 98.60 | 4058.09 |
| 151004675 | 989 | 989 | 1.0000 | 0 | 0.00 | 163.822 | 86.75 | 5450.00 | 95.38 | 8273.44 |
| 151117580 | 674 | 674 | 1.0000 | 0 | 0.00 | 157.156 | 70.77 | 3960.32 | 69.31 | 4904.53 |
| 997356301 | 140 | 142 | 0.9859 | 2 | 24.05 | 4.882 | 5.53 | 2419.32 | 42.34 | 233.97 |
| 997401343 | 943 | 1084 | 0.8699 | 141 | 5677.92 | 12.600 | 13.86 | 2929.34 | 51.26 | 710.29 |
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